volume 1

Northern Link

# environmental impact statement supplementary report

June 2009

BRISBANE CITY

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SKM Connell Wagner

JOINT VENTURE

# Northern Link
# Environmental Impact Statement

# Supplementary Report

June 2009

## Northern Link Supplementary Report Table of Contents

# 1. Introduction

## 1.1 Purpose of the Supplementary Report

This Supplementary Report to the Northern Link Environmental Impact Statement (EIS) of September 2008, has been prepared in response to a request from the Coordinator-General to the Proponent for the Northern Link Road Tunnel Project, Brisbane City Council (Council). The EIS was prepared in accordance with terms of reference (TOR) issued by the Coordinator-General under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). In reviewing the submissions received to the EIS during the notification period from 25 October 2008 to 22 December 2008, the Coordinator-General requested that a supplementary report be prepared by Council, to address the relevant matters raised in the submissions.

Following notification and public display of the EIS, 212 submissions were received, including 200 public submissions and 12 from Government agencies. One public submission has been subsequently withdrawn. The Coordinator-General has requested that the supplementary report include a table of all the matters raised in the submissions on the EIS with specific responses to each issue, or a cross-reference to where each issue is addressed in the supplementary report. The table of all the matters raised in the submissions on the EIS is included in **Appendix A** with a cross-reference to where each matter is addressed in the Supplementary Report.

The matters raised in the submissions have been grouped into issues with specific responses in **Appendix B** of the Supplementary Report. The issues identified have been taken from the matters raised in the submissions and each summary of the issue contains specific detail from the submission, together with a response to the issue.

Based on the submissions, the Coordinator-General has also requested the supplementary report to include corrections and clarification of the EIS together with further information considered necessary for the Coordinator-General to undertake a full assessment of the environmental impacts of the Project.

## 1.2 Consultation on the EIS

Community consultation undertaken during the public exhibition period for the EIS aimed to:

- notify the community that the EIS had been lodged for evaluation by the Coordinator-General and call for written submissions on the EIS;
- satisfy the statutory requirements of the SDPWO Act in relation to the exhibition of the EIS and invitation for written submissions;
- provide information to stakeholders and community members to enable their review of the EIS; and
- obtain input from Council and Queensland Government agencies on the EIS.

A range of communication and consultation activities was undertaken with community members and stakeholders to assist their review of the EIS as identified in **Appendix C** of this Supplementary Report. These included:

- public display of the EIS at 14 locations, including libraries, ward offices and state and federal electorate offices;
- distribution of Newsletter 4 to more than 90,000 households, businesses, property owners and other registered stakeholders inviting public comment on the EIS;
- three community information sessions and five staffed displays;
- one meeting of each of the Northern Link Community Reference Groups (west and north);

- agency briefings to Council and Queensland Government agencies reviewing the EIS;
- updating the EIS website and providing information through responses to the project information line, letters and emails; and
- availability of the EIS to purchase in hard copy, publication of the EIS on the project website, free copies of the EIS In Brief (hard copy) and free copies of the complete EIS on CD-ROM.

## 1.3 Coordinator General's Evaluation Report

Following this process, the Coordinator-General will prepare a report evaluating the EIS. In accordance with the SDPWO Act, the Coordinator-General in his evaluation report may:

- evaluate the environmental effects of the project and any other related matters;
- state conditions for later IDAS approvals required for the project;
- make recommendations for other approvals required for the project; and
- impose conditions for the undertaking of the project, where there is no other mechanism for conditions to be imposed ("imposed conditions").

In setting imposed conditions, the Coordinator-General may:

- state when the imposed conditions take effect; and
- nominate an entity that is to have jurisdiction for the condition ("the nominated entity").

# 2. Overview and Development of the Project

This chapter provides an overview of the public and agency submissions on the Northern Link EIS. It identifies the key issues raised in the submissions and the approach taken to the development of the Project in the light of the submissions received and the responses to the submissions as a consequence, as presented in detail in **Appendix B** of this Supplementary Report.

## 2.1 Background to the notification of the EIS submission period

The EIS was provided to the Coordinator-General on Tuesday 30 September 2008.

By public notice on Saturday 25 October 2008, the EIS was publicly notified until Monday 15 December 2008. By further public notice on Saturday 1 November 2008, following a request from the Council, the Coordinator-General decided to extend the submission period until Monday 22 December 2008.

During the submission period, any person could make a submission to the Coordinator-General about the EIS. The Coordinator-General was obliged to accept all properly made submissions and could also accept written submissions even if they were not properly made. Also, accepted submissions were able to be amended during the submission period by written notice, or withdrawn at any time before a decision about the EIS is made.

Copies of submissions were provided to Council, and a request was subsequently made to Council by the Coordinator-General to prepare a supplementary report to the EIS to address the relevant matters raised in the submissions.

## 2.2 Further development of the Project

The key project design issue raised, mainly through the public submissions but also from government agencies, was associated with the need for, cost of, and the adverse effects of the design and location of the local connections at Toowong and Kelvin Grove. Submissions also expressed a concern that a decision on local connections should not be driven by the tendering process.

Despite the identified strategic benefits of the local connections, the EIS recognised significant adverse and long term impacts at the local level and the difficulty and impact of the required mitigation measures for those impacts.

Council has now considered the submissions and further detailed assessment of the Reference Project without local connections. In weighing these competing matters, Council has decided now to proceed with the project without the local connections.

For the purposes of this Supplementary Report, the Northern Link project without the local connections is referred to as “the Project”. The project as described in the EIS is referred to as “the EIS Reference Project”.

The Project is described in Chapter 3 of this Supplementary Report, in relation to information provided in the EIS on the EIS Reference Project. An environmental impact assessment of the Project is provided in Chapter 4 of this Supplementary Report, in addition to information provided in the EIS on the Reference Project.

## 2.3 Overview of Submissions Received

The Coordinator-General accepted 212 submissions on the Northern Link EIS, including 200 submissions from the public and public organisations, as well as submissions from 12 government agencies. One public submission was subsequently withdrawn.

### 2.3.1 Submissions from Government Agencies

The 12 submissions received from government agencies are summarised below in **Table 2-1**.

**Table 2-1 – Summary of Government Agency Submissions**

| Government Department or Agency | Overview of Submission |
|---|---|
| Department of Community Safety (DCS) - (formerly Emergency Services (DES)) - including Queensland Ambulance Service (QAS) and the Queensland Fire and Rescue Service (QFRS). | ▪ It is considered that the EIS adequately addresses the ToR and the interests of the DCS. No further suggested solutions apply to the hazardous materials component, the natural hazards component, safety and emergency in regard to the traffic and transport component, to the social impacts component, and to the hazard and risk component.<br>▪ QAS advised no pending issues with the content of the EIS.<br>▪ QFRS sought undertakings to help ensure that the fire and life safety design will meet statutory requirements and also key lessons learnt from CLEM7 and Airport Link tunnel projects. |
| Department of the Environment and Resource Management (DERM) formerly the Environmental Protection Agency (EPA) | ▪ Various aspects applying to the scale and scope of Environmentally Relevant Activities (ERAs) apply to the project, including more detailed information and changes to the definitions of ERAs.<br>▪ The EIS identifies the likely effects upon places in the Queensland Heritage Register by the works and recommends certain actions to be taken for the development applications required and the need for mitigation works of a high order<br>▪ Contaminated land matters have been satisfactorily addressed in the EIS.<br>▪ The noise and vibration sections of the EIS are comprehensive and the bases put forward for calculating acceptable noise and vibration limits are considered to be appropriate.<br>▪ In regard to air quality, the approach is appropriate, and reflects contemporary practice in ambient air quality impact assessment.<br>▪ The overall conclusion that the tunnel project is unlikely to lead to significant changes in ambient air quality in future years is a reasonable conclusion to draw from the modelling output, and appears to be a realistic assessment of the situation.<br>▪ The assessment criteria used is the same that the DERM uses to assess air quality in Queensland and is considered to be reasonable to be used to evaluate the impact of the project on air quality.<br>▪ The mitigation measures to be undertaken in the construction phase to minimise the impact on air quality is adequately covered in the EIS. |
| Department of Transport and Main Roads (DTMR) formerly Queensland Transport (QT) | The submission covered a wide range of issues of interest to DTMR including the need to address matters through the supplementary report including:<br>▪ Neither the Project nor any upgrade (widening) of the Western Freeway between Moggill Road and the Toowong roundabout, should negatively impact on bus throughput along Moggill Road corridor.<br>▪ The Project should not preclude upgrades of the Centenary Highway nor the ICB as a consequence of the proposed development.<br>▪ Maintenance of connectivity and capacity for effective public transport services in the vicinity of the project throughout the construction and operation of the project.<br>▪ Maintenance of cycle and pedestrian connectivity on both principle regional cycle network and local connections throughout the construction and operation of the project.<br>▪ The provision of all cycle and pedestrian facilities in conformance with relevant |

| Government Department or Agency | Overview of Submission |
|---|---|
| | standards and guidelines.<br>■ Bus priority measures should not be precluded on Moggill Road, Milton Road and Coronation Drive.<br>■ The Northern Link must not, in any way, preclude, limit or impede the potential future provision of the "Inner Orbital" project from Toowong to Everton Park, as referred to in the Western Brisbane Transport Network Investigation.<br>■ No encroachment on the Queensland Rail corridor alongside the ICB.<br>■ No funding input to be required from the state government. |
| Department of Transport and Main Roads (DTMR) formerly Department of Main Roads (DMR) | The DTMR response covered a wide range of interests. Key issues included:<br>■ The "Inner Orbital" , as referred to in the Western Brisbane Transport Network Investigation, to be able to be designed and constructed with Northern Link in place.<br>■ Inner Orbital precedence and connection needs to be reflected in the EIS - ultimate four lanes each way and continuous high occupancy vehicle (HOV) lane to Milton Road.<br>■ Northern Link to be viable with no Centenary Motorway / Western Freeway (CMNLI) upgrade by the State.<br>■ The "agreed" position for the future upgrading of the Western Freeway / Centenary Motorway development of the Reference Design (2 general purpose (GP) lanes on the outside with single HOV lanes on the inside) is no longer supported by DTMR.<br>■ Council to consider improvements to the Western Freeway / Moggill Road interchange as part of the Northern Link project.<br>■ Council must design and construct pedestrian and cycle ways that form part of the project or that are impacted by the project.<br>■ Need for the Project to identify specific enhancements for active transport.<br>■ Construction access to the Western Freeway worksite unacceptable to DTMR from the motorway – access to be from Mt Coot-tha Rd via the roundabout. |
| Queensland Treasury | No signed submission was received from Treasury however comments were provided without letter head to the Coordinator-General and was accepted as a submission. Key comments included:<br>■ Need to consider the current global financial crisis in the assessment of the economic environment.<br>■ A cost benefit analysis (CBA) should be done on both straight-through option and the reference design.<br>■ Further explanation of the opportunities for improved freight transport required.<br>■ Need for further explanation of the toll price assumptions. |
| Disability Services Queensland (DSQ) | DSQ recommends the development of an Equitable Access Statement in consultation with DSQ prior to construction. |
| Department of Education and Training (DET) formerly the Department of Education, Training and the Arts (DETA) | ■ It would appear that the local containment of the Kelvin Grove suburb is to be affected, adversely, by the proposal. The size of the proposed portals would seem to be quite out of scale with the local area. Significant destruction of the urban fabric to make way for these portals will need to occur.<br>■ The access to Toowong State School is adversely affected – parents will need to negotiate additional lanes.<br>■ The car and bus travel needs of residents from the western suburbs of Brisbane would appear to be favoured to the detriment of the local Kelvin Grove and Toowong communities. |
| Department of Health | The potential health risks have been sufficiently identified and appropriate health risks have been sufficiently identified and appropriate mitigation strategies outlined. Specific issues that require additional consideration include:<br>■ Consultation with the Royal Brisbane and Women's Hospital and the Royal Children's Hospital regarding any changes to existing utilities to ensure that services are not disrupted.<br>■ The need to review cycle and pedestrian infrastructure to identify communities that may be disadvantaged by the project and advise if there are any plans to improve residents' opportunities to cycle or walk rather than needing to use motor vehicles to travel in their local area. |

| Government Department or Agency | Overview of Submission |
|---|---|
| | ▪ The provision of further information regarding [the project's] ability to meet the air quality objectives in the EPP (AIR) 2008 or additional mitigation measures that will be implemented to reduce dust levels in community areas affected by tunnel construction activities.<br>Based on the information presented in the EIS, Queensland Health is of the view that the construction and ongoing use of the roads of Northern Link will not result in an unacceptable increase in health risk to the community from the predicted small increase in air pollution levels. |
| Department of the Environment and Resource Management (DERM) formerly the Department of Natural Resources and Water (DNRW) | Additional information is required to enable the Department to exercise its range of jurisdictions in regards to the proposed Northern Link Road Tunnel. This information includes:<br>▪ An assessment of the proposed activity against the cultural heritage duty of care guidelines to help determine whether, or to what extent, Aboriginal cultural heritage may be harmed by the proposed development.<br>▪ Additional information to determine if State Planning Policy 2/02 [Acid Sulphate Soils] applies to the project.<br>▪ Clarification that the Vegetation Management Act 1999, and the Integrated Planning Act 1997, regulate not only the clearing of remnant native vegetation on freehold land, but also the clearing of remnant and non-remnant native vegetation on State land (including Council land that is not freehold).<br>▪ Activities within the bed and banks of any reach of a "non-tidal reach" water course will require a Riverine Protection Permit.<br>▪ The taking of or interfering with water in any non-tidal watercourse will require either a Permit or Licence to Take Water or a Licence to Interfere with the Flow of Water. |
| Department of Communities | The Department considers it is crucial that the communities impacted by the construction of the tunnel are kept fully informed about the project's development as well as the cumulative impacts and that appropriate measures are taken to ensure that the community concerns are monitored and responded to in a timely manner. |
| Police Department – formerly the Queensland Police Service | The impact of components of the project on traffic management needs to be considered during the planning phase. In particular, the impact of new on and off-ramps on traffic flow through existing road infrastructure needs to be examined in detail. |
| Department of Communities formerly including the Department of Housing | As far as possible, the EIS addresses the concerns that the Department of Housing raised in the Draft Terms of Reference, namely, access to and egress from the proposed road tunnel and the location of ventilation shafts. |

### 2.3.2 Public Submissions

As identified in **Appendix C**, over 80% of public submissions received from the community explicitly referred to the proposed local connections to Toowong and Kelvin Grove. The submissions questioned the planning and traffic need for these local connections, particularly the Toowong connection. The submissions further questioned the rationale for the local connections. About 77% of all community submissions referred to the Toowong connection and about 13% referred to the Kelvin Grove connection. The majority of submissions were opposed to the local connections on various grounds including increased local traffic and associated noise and air quality, issues of local pedestrian and cycle connectivity, social connectivity and amenity, loss of local character housing, visual impact and impacts associated with construction.

A brief summary of the key common issues across the whole project, and also the key local issues, associated largely with the local connections and Toowong and Kelvin Grove Road, is presented below in **Table 2-2**.

## Table 2-2 - Summary of Issues in Submissions

| | |
|---|---|
| **Key Common Issues** | Project design issues:<br>■ need for the local connections;<br>■ lack of assessment of the "straight through" option;<br>■ lack of commitment to and enhancement of pedestrian and cycle opportunities;<br>■ increased traffic on local surface roads, which would result in increased traffic noise and decreased roadside air quality;<br>■ general air quality issues associated with ventilation outlet locations and lack of filtration on ventilation outlets; and<br>■ visual impact and urban design issues associated with the local connections and associated noise barriers. |
| | Project delivery issues:<br>■ reduced air quality due to dust generated by construction activities, including spoil removal from worksites and placement of spoil in the Mt Coot-tha Quarry;<br>■ vibration generated by tunnelling works, including its potential to result in cosmetic or structural damage to buildings along the tunnel alignment, including the Toowong Cemetery;<br>■ noise generated by surface works and tunnelling in shallow areas;<br>■ reduced values of properties in the vicinity of worksites and surface works;<br>■ changes to bus routes and the location of bus stops, due to surface works and worksites;<br>■ construction traffic management, including spoil haulage and parking for construction workers;<br>■ reduced pedestrian and cycle access around worksites; and<br>■ duration of construction program, particularly in terms of the impact on nearby residential communities. |
| **Key Local Issues** | Toowong connection:<br>■ reduced pedestrian and cycle connectivity along and across major roads (i.e. Milton Road, Croydon Street);<br>■ increased traffic on Croydon Street, Jephson Street and Milton Road, and associated concerns regarding increased traffic noise, decreased roadside air quality, reduced pedestrian and cycle connectivity;<br>■ project would encourage rat-running through Toowong to allow access to/egress from the tunnel e.g. from Frederick Street to Morley Street and through Cadell Street and Bayliss Street;<br>■ changes to local access;<br>■ loss of locally important places and vegetation (e.g. Quinn Park and Crows' Ash Memorial);<br>■ reduced urban amenity, including removal of service station in Toowong and reduced access to local schools, shops and facilities;<br>■ reduced visual amenity, due to the widening of Croydon Street and Milton Road, the elevated ramp structures, and noise barriers along Croydon Street;<br>■ location of the western ventilation outlet, due to its proximity to residential communities in west and north Toowong, and its potential impacts on ambient air quality and associated concerns about health impacts; and<br>■ resumption of properties required to construct the local connection, including removal of character homes and the potential changes to the demographic profile of the community. |
| | Kelvin Grove Road Connection:<br>■ project fails to improve pedestrian and cycle access across and along Kelvin Grove Road;<br>■ potential impact on access to Kelvin Grove Urban Village and local streets;<br>■ loss of locally important places and vegetation (e.g. fig trees in Marshall Park);<br>■ location of the eastern ventilation outlet, due to its proximity to residential communities, schools and hospitals, its potential impacts on ambient air quality and associated concerns about health impacts; and<br>■ increased traffic on Kelvin Grove Road and the ICB, and associated concerns regarding increased traffic noise. |

### 2.3.3 Response to submissions

Each submission received by the Coordinator-General that was not withdrawn has been summarised in **Appendix A** to this Supplementary Report. A response to each of the issues raised in each submission has been provided in **Appendix B** to this Supplementary Report.

The submission summary in **Appendix A** includes a cross-reference to where each matter is addressed with specific responses in **Appendix B** to the Supplementary Report. The issues identified have been taken from the matters raised in the submissions and each summary of the issue contains specific detail from the submission, together with a response to the issue.

## 2.4 Draft Outline Environmental Management Plan

The Draft Outline Environmental Management Plan included in Chapter 19 of the EIS has been updated for the Project. The Draft Outline Environmental Management Plan for the Project is included in **Appendix D** to this Supplementary Report.

## 2.5 Urban Mitigations

For the EIS Reference Project, the EIS proposed a comprehensive suite of urban mitigations (Chapter 20) in addition to the environmental management measures and mitigation measures (Chapter 19) for the construction and operational phases of Northern Link. The urban mitigations were proposed to off-set wider community impacts associated with the construction and operation of Northern Link, whereas the mitigation measures identified in the Draft Outline Environmental Management Plan are proposed to avoid or mitigate and manage direct predicted impacts identified in the EIS and through this Supplementary Report.

The removal of the local connections at Toowong and at Kelvin Grove removes many of the impacts predicted to affect those localities. Consequently, the need to provide urban mitigations in these localities is significantly reduced. However, the need for urban mitigations in the vicinity of the mainline portals at Mt Coot-tha and at Herston remains.

The urban mitigations that would be provided in Toowong as part of the Project are presented in **Table 2-1**.

**Table 2-1: Urban Mitigations for the Project at Toowong**

| Category | Location | Mitigation Measures | Priority |
|---|---|---|---|
| Pedestrian and cycle ways | Mt Coot-tha Road (Western Freeway to Botanic Gardens gate) | Provision of off-road pedestrian and bicycle path from the western end of the DMR path from Western Freeway to the entrance of the Botanic Gardens. | High |
| | Sylvan Road to Western Freeway bikeway (Anzac Park, adjacent Dean Street) | Enhance existing off-road bikeway by providing improved and safer pedestrian and cycle crossovers at Dean Street and Miskin Street. | |
| Open space | Mt Coot-tha Botanic Gardens | Rehabilitate that area of the gardens disturbed by construction activities, consistent with the Mt Coot-tha Botanic Gardens Master Plan including:<br>▪ Planting (i.e.: to dam surrounds, desalination research facility, and sculptured earth berms).<br>▪ Provision of sculptured earth | High |

| Category | Location | Mitigation Measures | Priority |
|---|---|---|---|
| | | berms comprising detailed mounding and turfing of the worksites.<br>▪ BBQ's, shelters, drinking fountains, age appr.opriate play opportunities, park furniture and lighting | |
| Public art | Mt Coot-tha | Provide high-quality public art enhancements to the design and construction of the ventilation outlet, ventilation station and adjacent project buildings | High – subject to consultation for public art strategy |

The urban mitigations that would be provided in Herston as part of the Project are presented in **Table 2-2**.

### ▪ Table 2-2: Urban Mitigations for the Project at Herston

| Category | Location | Mitigation Measures | Priority |
|---|---|---|---|
| Amenity | Normanby Terrace | Reinstate noise walls to ICB to achieve status quo design specification. | Medium – subject to consultation and detailed design |
| | Victoria Park Road (Maidstone Street to ICB) | Streetscape works including build-outs and tree planting to side streets at intersections with Victoria Park Road | Medium – subject to consultation and detailed design |
| Pedestrian and cycle ways | Victoria Park | Reinstate the pedestrian and cycle path disturbed by construction works along ICB. | High |
| Open space | Victoria Park | Enhancement of existing park and golf course perimeter including:<br>▪ rehabilitation of construction area; and<br>▪ reinstatement and enhancement of ped/cycle links between Herston and Kelvin Grove. | High |
| Public art | Herston | Provide high-quality public art enhancements to the design and construction of the ventilation outlet, ventilation station and adjacent project buildings | High – subject to consultation for public art strategy |

# 3. Description of the Project

The EIS provided a comprehensive assessment of the Reference Project including local connections, cognisant that through the bid process innovation would be sought and changes to the project may eventuate. Council has continued to investigate the feasibility of the Reference Project. The EIS attracted many submissions opposing local connections, primarily on the grounds of property impacts and changes to the character of the neighbourhood, the details of which are summarised in **Appendix A**. Many of the submissions also expressed concern that a decision on the local connections should not be driven by the tendering process. Despite the identified strategic benefits of the local connections, the EIS recognised significant adverse and long term impacts at the local level and the difficulty and impact of the required mitigation measures for those impacts.

Council has now considered the submissions and further detailed assessment of the Reference Project without local connections. In weighing these competing matters, Council has decided now to proceed with the project without the local connections.

The Project design is shown in **Volume 2 – Supplementary Report Northern Link Project Design**, including planning layouts, cross sections, longitudinal sections, construction site plans, traffic management and staging, ventilation site plans and estimated tunnel settlement contours.

## 3.1 General Description of Northern Link

The Project is approximately 7km long, including all new line marking and surface road works on the Inner City Bypass (ICB) and the Western Freeway. The eastbound tunnel is approximately 4.6km long and the westbound tunnel 4.9km long, mainly in hard competent rock below Toowong, Auchenflower, Paddington, Red Hill and Kelvin Grove. Surface works would extend into Mt Coot-tha and Herston. The road tunnels would link the Western Freeway at Toowong with the ICB at Kelvin Grove/Herston. The Project would include:

- two separate parallel road tunnels of uniform cross-section throughout and at least 10m apart, one for eastbound traffic and one for westbound traffic, each with two lane carriageways and connected by cross passages every 120m along their length;
- tunnel portals to the surface:
  - on the Western Freeway just west of the Mt Coot-tha Road roundabout at Toowong; and
  - on the ICB near its junction with Victoria Park Road at Kelvin Grove / Herston;
- tunnel management, fire and life safety, mechanical and electrical systems, ventilation systems; and
- alterations to surface roads to connect the tunnels into the existing road network.

The Project does not include, as was proposed in the EIS Reference Project:

- tunnel portals to the surface:
  - just northeast of the intersection of Milton Road and Frederick Street; and
  - on the western side of Kelvin Grove Road at its junction with Musk Avenue.
- underground Y-junctions with the mainline tunnels; and
- alterations to surface roads such as Milton Road, Croydon Street, Jephson Street, Kelvin Grove Road, Victoria Street, Upper Clifton Terrace, in the vicinity of the removed portals.

## 3.2 Project Design

Design standards remain the same as the EIS.

The tunnel configuration remains essentially as presented in the EIS, with the horizontal alignment of the tunnels unchanged. Westbound traffic entry to the tunnel would be provided only from the ICB. Westbound traffic exit would be provided only to the Western Freeway. Eastbound traffic would gain entry to the tunnel only from the Western Freeway and exit only onto the ICB.

Removal of the Kelvin Grove local connection has allowed a change in the mainline tunnel gradients at the eastern end of the tunnels between Beck Street (Paddington) and Kevin Grove Road. This has allowed for a deepening of the tunnels in some locations as depicted in the shaded sections in **Table 3-1** at identifiable locations along the alignment of the tunnels.

**Table 3-1 Approximate Depth from Existing Surface to Crown of Project Tunnels**

| Location | Eastbound Tunnel Depth (m) | Westbound Tunnel Depth (m) |
|---|---|---|
| Western Driven Tunnel Portal | 11 | 9 |
| Toowong Cemetery | 15 | 16 |
| Frederick Street (near its intersection with Thorpe Street), | 36 | 33 |
| Birdwood Terrace (east of its intersection with Fairseat Street), | 58 | 58 |
| Carrington (intersection with Daintree Street) | 60 | 66 |
| Baroona Road (between Howard and McNab Streets), | 50 | 48 |
| Beck Street (west of its intersection with Nash Street), | 30 | 30 |
| Fernberg Road (east of its intersection with Ellena Street) | 29 (+1)[1] | 29 (+1) |
| Latrobe Terrace, north of its intersection with Cochrane Street, | 48 (+3) | 48 (+5) |
| Hayward Street (between Plunket and Charlotte Streets), | 20 (+10) | 20 (+7) |
| Cairns Terrace at its intersection with Great George Street, | 43 (+10) | 47 (+7) |
| St Brigid's Church on Musgrave Road, | 48 (+4) | 48 (+4) |
| Kelvin Grove Road (north of the ICB) | 16 | 15 |
| Eastern Driven Portal | 9 | 8 |

Table source – Northern Link EIS Sept 2008 – Table 4-2.

**Table Notes:**

Numbers shown in brackets are the change in tunnel depth as shown in the highlighted cells compared to the EIS Reference Project.

The alignment for the tunnels is based on a number of factors, including:

- road geometry based on design speed, sight distance, desirable gradients and the need to connect into the existing levels at the surface connections; and
- geotechnical conditions, including groundwater conditions, particularly at the Western Freeway connection.

### 3.2.1 Surface Road Connections

The layout of the Western Freeway connection has changed marginally to suit DTMR requirements. The alignment of the transition structures from the cut and cover portals to the surface have been moved closer to the Western Freeway alignment[1]. This also has the effect of reducing the area of land required for roadworks and associated embankments or cuttings on both sides of the Western Freeway in Anzac Park and adjacent to the Mt

[1] Between chainages 200 to 750 on Northern Link Planning Layout No 2 of 11 (Drawing No. EIS_PL_03 RevB) in Supplementary Report Volume 2 – Project Design.

Coot-tha Botanic Gardens. The design retains the future planning requirements of DTMR for the Western Freeway to include three lanes each way to the Mt Coot-tha Road roundabout.

There is no change to the eastbound surface road diverge from the Western Freeway to the Northern Link carriageway. The location of the westbound merge from the 2-lane Northern Link carriageway to a single lane carriageway remains, however the extent of the westbound single lane Northern Link carriageway has been increased from 100m to 200m prior to its final merge with the outer lane of the Western Freeway in order to meet DTMR requirements. This has created a consequential extension to the length of the westbound connection including for the bicentennial bike path.

The layout of the ICB connection[2] remains as presented in the EIS Reference Project[3] except that the outer and centre lanes of the 3-lane ICB westbound continue as the ICB with only the inner lane dedicated to the Northern Link tunnel. The EIS Reference Project lane arrangement had both centre and inner lanes being dedicated to the Northern Link tunnel. With the Project, the centre lane on the ICB allows for a diverge right into the outer lane of the 2-lane Northern link tunnel but remains dedicated to the ICB. The effect of these changes to the lane marking is to give priority to the continuation of the ICB traffic lanes.

### 3.2.2 Ventilation Stations and Outlets

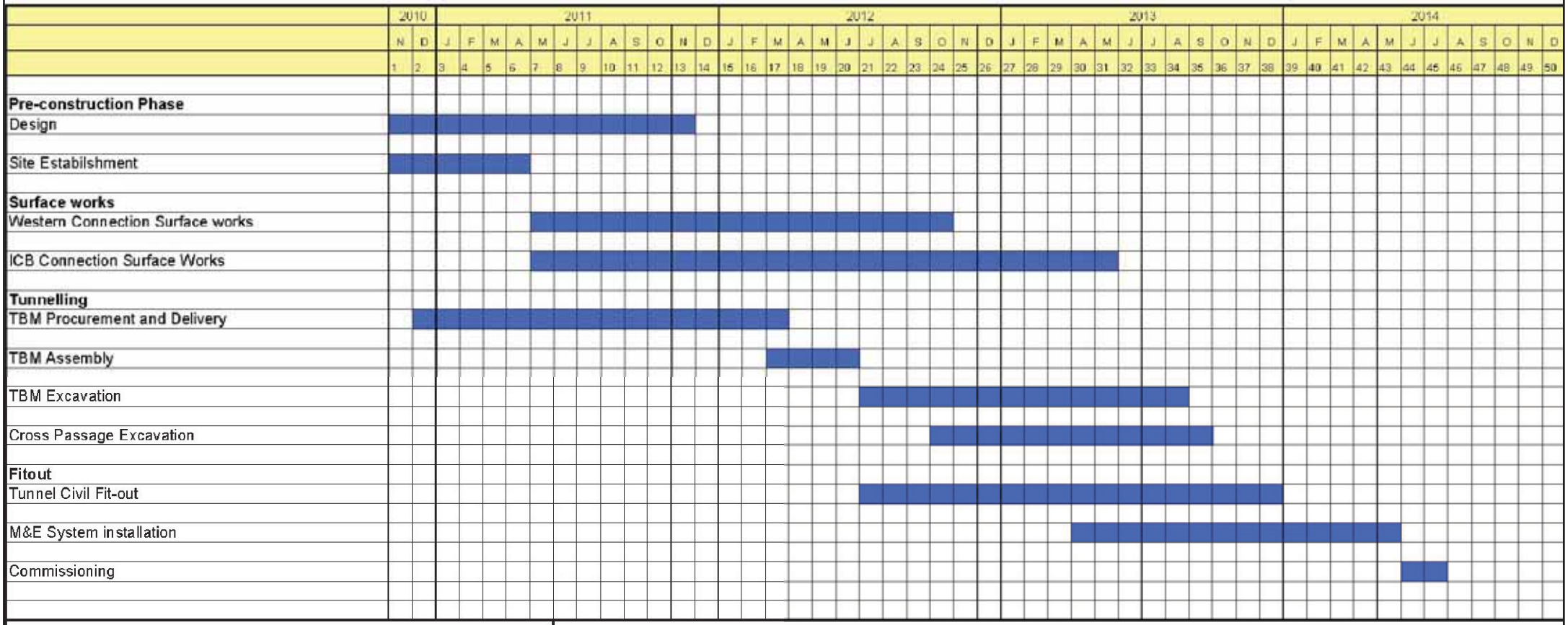
The proposed sites for the ventilation stations and associated ventilation outlets required near the exit from each of the mainline tunnels and shown on Figures 4-12 and 4-13 of the EIS (pp. 4-26 and 4-27) for the western and eastern sites respectively remain as described in the EIS.

## 3.3 Project Delivery Mode

### 3.3.1 Program and Responsibilities

An updated preliminary works program for the Project is shown in **Figure 3-1**. Construction has been assumed to commence in late 2010, subject to a number of factors including the Coordinator-General's evaluation of the EIS. The overall design and construction would take approximately 45 months, with the tollroad open to traffic by mid 2014.

[2] Supplementary Report Volume 2 Project Design, Planning Layout 10 of 10 (Drawing No.EIS-PL-10 Rev B)
[3] EIS Volume 2 EIS Reference Design, Planning Layout 11 of 11 (Drawing No. EIS-PL-11 Rev A)




Duration 45 months

Northern Link

Summary Construction Programme

Based on Straight Through Concept Design

### 3.3.2 Establishment and Preliminary Works

The tunnels would be constructed from a single major worksite located on the northern side of the Western Freeway adjacent to the Mt Coot-tha Botanic Gardens which would provide a launch area for the Tunnel Boring Machine (TBM) as well as a base for surface works.

The construction works at the ICB connection will, as described in the EIS, (Chapter 4) involve road reconfiguration and the removal of the TBM on its completion of the tunnel construction. Widened areas of the cut and cover tunnels at the ICB connection may be required for disassembly and removal of the TBMs.

#### Property Requirements

The Project will not require surface resumption of any private properties at the Western Freeway Connection. At the ICB connection, property requirements are unchanged. Previously indicated privately owned surface land in Red Hill/Kelvin Grove/Herston and Mt Coot-tha/Toowong is no longer required and will not be resumed for surface works. Anicipated property requirements for the Project compared to the EIS Reference Project are shown in **Table 3-2.**

- **Table 3-2 Anticipated Property Requirements**

| Location | State Owned | | Council Owned | | Privately Owned | | Total | |
|---|---|---|---|---|---|---|---|---|
| | EIS | Project | EIS | Project | EIS | Project | EIS | Project |
| Kelvin Grove/Herston | 4 | 4 | 8 | 4 | 30 | - | 42 | 8 |
| Mt Coot-tha/Toowong | 1 | 1 | 7 | 4 | 66 | - | 74 | 5 |
| **Total** | **5** | **5** | **15** | **8** | **96** | **-** | **116** | **13** |

The Project also anticipates approximately 374 (614 for EIS Reference Project) parcels of land would be affected by volumetric title reconfiguration (subdivision) and acquisition to provide separate tenure for the underground tunnels while retaining the surface title rights by the existing owners. This figure may be refined during detailed design depending on construction methodology and geological conditions.

#### Tunnel Portal Cover Sheds (TPCSs)

Acoustically lined TPCSs would no longer be required at Milton Road and Kelvin Grove Road. At the Western Freeway worksite, the TPCS configuration is as described in the EIS.

#### Demolition and Utility Modifications

The Project requires no demolition of buildings. Other site preparation and utility modification activities are as described in the EIS.

### 3.3.3 Tunnel Construction

There is a significant reduction in the volume of spoil produced during construction as a result of the removal of the local connections. The TBM for each of the tunnels would still be launched from the Western Freeway worksite with the TBM cutting heads disassembled and removed within the cut and cover tunnel sections at the ICB connection. Cut and cover sections and transition structures to the surface would be constructed at the Western Freeway and ICB connections as described in the EIS. The rehabilitation of the worksite at the Western Freeway would be undertaken in consultation with the Mt Coot-tha Botanic Gardens and in consideration of the Masterplan for the future development of the site as described in the EIS.

## Traffic and Access during Construction

Changes and potential disruptions to traffic and access arrangements during the construction phase are removed from the Milton Road and Kelvin Grove Road areas. Maintenance of the efficient traffic flow along the Western Freeway and the ICB and access to the worksites during construction would be achieved with traffic staging as described in the EIS and refined further during the detailed design phase.

## Construction Spoil

The estimates of spoil quantities, placement and truck numbers for the Project are provided in **Table 3-3**.

- **Table 3-3 Total Spoil Quantity Estimates and Placement Locations**

| Worksites and Construction areas | Mt Coot-tha Quarry (Bank $m^3$) | | Swanbank (Bank $m^3$) | | Port of Brisbane (Bank $m^3$) | | Spoil Quantity Estimate (Bank $m^3$) | |
|---|---|---|---|---|---|---|---|---|
| | EIS RP | Project | EIS RP | Project | EIS RP | Project | EIS RP | Project |
| Western Freeway | 840,000 | **973,000** [2] | 265,000 | **265,000** | NIL | **NIL** | 1,105,000 | **1,238,000** |
| Toowong (Milton Road) | 240,000 | **NIL** | 20,000 | **NIL** | NIL | **NIL** | 260,000 | **NIL** |
| Kelvin Grove Road | NIL | **NIL** | NIL: | **NIL** | 300,000 | **NIL** | 300,000 | **NIL** |
| ICB | NIL | **NIL** | NIL | **NIL** | 25,000 | **25.000** | NIL | **25,000** |
| **Total Spoil** | 1,080,000 | **973,000** | 285,000 | **265,000** | 325,000 | **25,000** | 1,690,000 | **1,263,000** |
| **Total truck numbers (each 13$m^3$)** | 18,500 [1] | **Conveyor** | 22,000 | **20,400** | 25,000 | **2000** | 65,500 | **22,300** |
| **Duration of works (months)** | 14 | **14** | 14 | **14** | 23 | **23** | | |
| **Average number of truck loads per day** | 43 | **NIL** | 60 | **58** | 52 | **3** | | |

Table Notes

1) From the Milton Road Worksite to the Western Freeway Worksite for transfer to the conveyor

2) The increase estimate includes material that would now be removed by the TBM through the area of the EIS Reference Project Y-junctions. These Y-junctions are no longer required and the "additional" spoil includes the area of the mainline tunnel through these junctions, previously attributed to part of the construction of the local connecting ramps and their spoil removed from the local worksites, now no longer required.

Opportunities for reuse of spoil in the construction of embankments/reinforced earth at the Milton Road ramps are removed in the Project but potential for use of suitable spoil as invert fill in sections of the TBM driven tunnels remains.

## Energy

At the Western Freeway worksite, the estimated electrical demand during construction would increase marginally by 900kVA to approximately 22,500kVA, but the electrical demand estimated for the Milton Road and Kelvin Grove worksites (6870kVA at each) would no longer be required. The increase at the Western Freeway worksite is because the TBM will now excavate the sections of tunnel that, in the EIS, were the underground Y-junctions that would have been constructed by road headers with the TBM walked through the open space (ie no electrical demand during that section of the construction). A low voltage requirement of 100kVA at the ICB work area would be sourced from the existing distribution system.

## Water

The Project would need water supplied to the Western Freeway worksite only so halving the total estimated water requirements as shown in **Table 3-4**.

- **Table 3-4 Water Requirement Estimates per day**

| Worksite | Non-Potable (L/day) | Potable (L/day) | Total (L/day |
|---|---|---|---|
| EIS Reference Project | 210,000 | 70,000 | 280,000 |
| The Project | 110,000 | 30,000 | 140,000 |

Minor requirements for water at the ICB construction works for dust control etc, would likely come from non-potable recycled water locations off-site and trucked to the site for dust control spraying.

The likely sources for water supply remain unchanged, being groundwater from the production borehole in the Mt Coot-tha Botanic Gardens, supplemented if necessary by drawing on the water storage in the Mt Coot-tha Quarry pit. Should the quality of water obtained from the borehole need to be improved to meet the construction purpose, treatment facilities may need to be incorporated into the Western Freeway worksite.

### Materials

During construction of the Project, the revised estimates of quantities of concrete and asphalt required would be as follows:

- approximately 15% less concrete than reported in the EIS or approximately 153,000 m3; and
- approximately 15% less asphalt than reported in the EIS or approximately 48,500 tonnes.

### Workforce

Due to the specialist environment of the tunnel construction, the labour force would consist mainly of skilled technicians with a small portion of general skilled construction workers. The possibility for job training and skills development would be investigated as a measure to increase the local component of the labour force for both tunnel construction and surface works.

Typical labour requirements (full-time equivalents) for the construction phase of the Project compared to the EIS Reference Project are provided in **Table 3-5**.

- **Table 3-5 Employment Potential**

| Staff Category | EIS Reference Project (full-time equivalents) | The Project (full-time equivalents) |
|---|---|---|
| Tunnelling works | 200 | 200 |
| Surface works at the connections | 230 | 140 |
| Mechanical and electrical fit-out | 120 | 100 |
| Project management (site management, head office, etc) | 65 | 50 |
| **Total** | **615** | **490** |

Based on known peak employment figures for the CLEM7 project, it is estimated that up to 1,400 people would be directly employed by the Project at any one time.

## 3.4 Project Operations Mode

Description of the management regime, including a tunnel control centre, traffic management system and electronic tolling system remain as described in the EIS

## Tunnel Ventilation

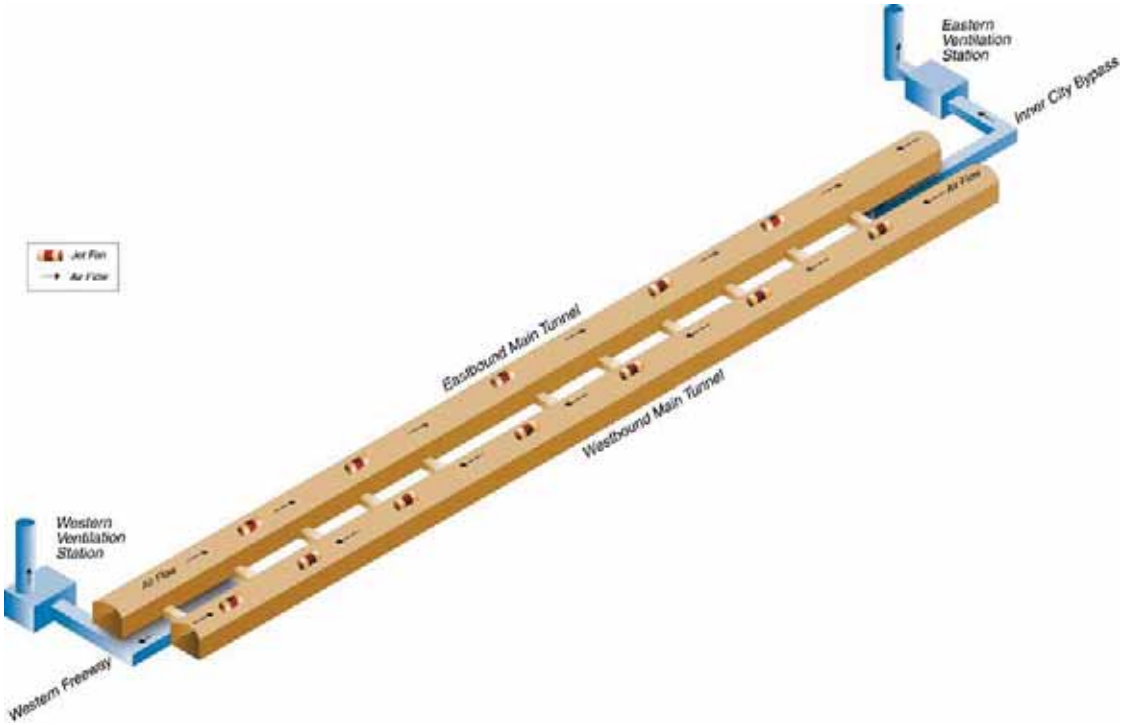
The longitudinal ventilation system proposed for the Project is simplified, compared to that in the EIS, by removal of the entry/exit ramps, as shown in **Figure 3-2**. As per the EIS, each of the tunnels would be equipped with its own ventilation system, which draws air in at each of the portals (entry and exit) to achieve acceptable in-tunnel air quality as well as to minimise the potential for vitiated air escaping from the exit portals.

The tunnel ventilation system has been re-evaluated for the Project. The number of jet fans required along each tunnel ceiling to promote directional air movement would be increased due to the loss of an intake portal for each tunnel with the removal of the local connections. The ventilation system relies on air flow being maintained in each tunnel, particularly during peak traffic conditions in the mornings and evenings. To this end, the additional jet fans in the tunnel roofs would be operated to maintain air flows sufficient to meet the in-tunnel air quality standards in all traffic conditions, including the AM and PM peak periods. This updated system for the Project has the capacity to maintain the Permanent International Association of Road Congresses (PIARC) recommended limits on the concentrations of motor vehicle emissions within a tunnel as set out in the EIS:

- 70ppm (parts per million) of CO with peak traffic flows >10kph, with up to 90ppm during extreme congestion (traffic flows <10 kph);
- an average of 1ppm of $NO_2$; and
- a visibility limit[4] of 0.005$m^{-1}$ for free flowing traffic and 0.007$m^{-1}$ for congested traffic[5].

On going and continuous monitoring of in-tunnel air quality would be linked to a system of traffic management to maintain appropriate traffic flows and consequent emission levels within the nominated air quality goals.

- **Figure 3-2 Ventilation System**




[4] the limit values are applied to ventilation sizing and refer to an "extinction or visibility coefficient based on the decay of a light beam as it passes through smoky air - K = 0.003$m^{-1}$ describes clear tunnel (visibility several hundred meters) and K = 0.007$m^{-1}$ describes a foggy atmosphere

[5] Extreme traffic congestion occurs when traffic flows are less than 10 km/h

## Electrical Supply

The dominant electrical operating load is associated with the tunnel ventilation and it is this load group that would generally determine the peak load. Two ventilation stations are proposed, one at each end of the mainline tunnel. Effective operation of the ventilation system requires peak demands and operational requirements remaining as presented in the EIS.

## Permits, Licences and Approvals

The approvals, permits and licences required for the project were outlined in Section 4.6 of the EIS. Since the EIS was lodged, legislative changes, including the new Environmental Protection Regulation 2008, have resulted in changes in some of the approvals requirements. The environmentally relevant activities that are likely to be required for the Project as a result of the new Environmental Protection Regulation 2008 may include:

- ERA 51 - Operating a Road Tunnel Ventilation Stack;
- ERA 8 – Chemical storage;
- ERA 63 – Sewage treatment;
- ERA 64 – Water treatment;
- ERA 16 – Extractive and screening activities; and
- ERA 43 – Concrete batching.

The scale and nature of the proposed ERA works, where necessary, are to be addressed in development approval applications for such works as finally proposed following detailed design. Operating conditions are recommended in relation to ERA 51, in Section 6.2.2 of the Supplementary Report.

# 4. Assessment of the Northern Link Project

This supplementary assessment provides information on the effects of the Project without the local connections at Toowong and Kelvin Grove as described in Chapter 3 and shown on the Project design drawings in Volume 2 of this Supplementary Report. The assessment of the Project is also presented where necessary in comparison with the assessment of the EIS Reference Project as presented in the EIS.

## Summary of findings contained in this Chapter

The Project offers significant traffic network and associated public and active transport benefits including:

- traffic reductions by 2026 on regional, orbital and local routes including the Ipswich Motorway (-10%), CLEM7 (-11%), Ipswich Road (-18%) Fairfield Road (-18%) and the MetRoad 5 corridor, Frederick Street (-9%), and Jubilee Terrace (-5%);
- redistribution of traffic from arterial and local roads onto motorway standard roads;
- a strong cross-city function (over 86% of all trips);
- sound level reductions as a result of traffic relief by 2026 of about 14% on Coronation Drive and 6% on Milton Road;
- traffic relief by 2026 on Moggill Road through Toowong by 18% to 40,800 vehicles per day;
- benefit for the Toowong activity centre from traffic reductions including a forecast decrease by 23% at High Street in 2026, which would be lower than existing traffic levels;
- daily traffic reductions by 2026 on many City Distributors such as Sylvan Road south of Croydon Street (-10%), Caxton Street (-11%) and Latrobe Terrace (-12%);
- reductions in daily traffic by 2026 on many local streets throughout the inner west suburbs such as Eagle Terrace (-11%), Haig Road (-5%), Stuartholme Road (-10%), Rainworth Road (-38%), Sylvan Road east of Milton Road (-11%), Morley Street (-11%) and Birdwood Terrace (-12%);
- substantial travel time savings for Northern Link users (up to 20 minutes or almost 70% faster) - between Centenary Bridge and Inner City Bypass during the am peak period in 2026) and reduced travel times for non-users on the surface network via both Milton Road and Coronation Drive;
- complementing Coronation Drive as the primary route for bus movements through the implementation of a T2 bus/transit lane inbound on Coronation Drive;
- opportunities for public transport travel time savings (5 mins) and improved reliability via congestion relief on Milton Rd/Coronation Drive corridor;
- traffic reductions along Sylvan Road would enhance this key linkage for cyclists between the Western Freeway bikeway and Bicentennial Bikeway.

The assessment for the Project compared with the EIS Reference Project shows that there are some changed impacts (generally reduced impacts) as a result of updated modelling and the removal of the local connections. The assessment shows that:

### *Traffic & Transport*

- The Project would cater for approximately 34% to 39% less vehicles per day than the EIS Reference Project.
- The forecast increase of daily traffic on the Western Freeway-Centenary Highway corridor for the Project is marginally less (-1%) than for the EIS Reference Project in 2014 and 2026.

- The forecast increase of daily traffic on the ICB for the Project is greater (+4% and +7%) than for the EIS Reference Project in 2014 and 2026 respectively. These traffic volume changes with the Project can be satisfactorily accommodated within the planned interchange and intersection arrangements in the Bowen Hills area that will be implemented with the CLEM7, Airport Link and Northern Busway projects.
- The Project has increased traffic at the connections of the Western Freeway to Moggill Road compared to the EIS Reference Project. These connections could be satisfactorily managed with signal co-ordination in early years post Northern Link opening with the forecast traffic volumes. Ultimately upgrades to the interchange configuration at Moggill Road are anticipated in association with upgrading of the Centenary Motorway with implementation of the State's SEQIPP transit lane project (or similar) in the 2016 to 2026 time-frame and in association with any future WBTNI connection within the Western Freeway.
- The Project would have reductions in traffic in the Toowong area compared to the scenario without Northern Link for Jephson Street (-4%), Sylvan Road (-10%), Burns Road (-4%) and Morley Street (-11%), in 2026. By comparison, some of these roads had increases in traffic with the EIS Reference Project.
- Croydon Street traffic volumes with the Project are forecast at 4% higher than without the project but 31% lower than forecast for the EIS Reference Project by 2026.
- No worksites would be required adjacent to Milton Road or Kelvin Grove Road. As a result, no construction traffic impacts are expected in these areas. In particular, the changes in local access, public transport and active transport routes in the Milton Road and the Kelvin Grove Road areas identified for the construction of the EIS Reference Project would not occur with the Project.
- Spoil haulage traffic generation from the Milton Road and Kelvin Grove Road worksites would be removed and there will be a reduction in the spoil produced by the Project compared to the EIS Reference Project. Most of this decrease would be on the Port of Brisbane route from the removal of the Kelvin Grove Road worksite and the associated spoil haulage from the construction of the ramps. Spoil haulage traffic would be reduced by over 90% from the estimated average truck loads per day over the 23 month construction period of 52 with the EIS Reference Project to 3 with the Project.

### *Air quality and health*

- While there will be differences in the traffic distributions with the Project from the ICB, the "worst-case" health impacts at this location would be no greater than those identified in the EIS for the Reference Project close to the Western Freeway.
- Even though the total traffic numbers in the tunnel would be less than those predicted in the EIS, the predicted "worst-case" impact of emission from the ventilation outlets remain as presented in the EIS, based on peak hour or "congested" periods of use.

### *Construction impacts*

- The Project will avoid construction impacts and changes in access to local community facilities and pedestrian and cycle networks on residential properties and local businesses at Milton Road, Valentine Street and Croydon Street and changes to local access and connectivity and impacts of construction works on local character and amenity at Lower Clifton Terrace and at Westbury and Victoria streets.
- The identified potential for construction works to impact on the amenity of residential areas is no longer relevant with regard to those areas identified in the EIS affected by the construction of the local connections in Toowong and Red Hill / Kelvin Grove.
- The Project construction sites and surface works associated with the Toowong and Kelvin Grove local connections would not be required. Therefore, all noise and vibration impacts identified in the EIS associated with these construction sites/surface works would no longer occur. This would have greatest benefit for residential areas directly adjacent to the Milton Road and Kelvin Grove Road worksites.

- The extension of the roadworks on the Western Freeway for a further 100m to accommodate a longer merging lane than proposed in the EIS Reference Project, would not alter the noise impacts as the distance from nearest residences is more than 110m, similar to separation distances from other residential areas along the Western Freeway.
- With removal of the Toowong or Kelvin Grove local connections the depth of the mainline tunnels would alter. The greater depth of the mainline tunnels would mean significant reductions in regenerated noise and vibration from the operation of the TBMs in the shallowest areas (e.g. vibration levels would approximately halve if the tunnel depth went from 10m to 15m and there would be a "noticeable" approximately 5 dBA reduction in regenerated noise level over the same increase in depth).
- Compared to the EIS Reference Project, construction traffic noise will not change or very negligibly decrease from the EIS Reference Project levels

### *Operational noise*

- All noise sensitive locations adjacent to the Western Freeway are still predicted to comply with Main Roads' 68 dBA $L_{A10(18hour)}$ planning noise level with noise levels of 61 dBA $L_{A10(18hour)}$ or less.
- Noise barriers recommended in the EIS along Frederick Street, Milton Road and Croydon Street to mitigate the operational effect of the Toowong connection would no longer be required.
- No barriers along Kelvin Grove Road would be required as there would be no road works in this area.
- Noise barriers directly adjacent the ICB would be required as proposed in the EIS and their height in some areas increased to mitigate the marginal increase in predicted noise levels. No increase would be required where Planning Noise Level barriers are already proposed at 8m with increases from 6m to 6.5m elsewhere. An increase in height of 'Status-Quo' barriers in the order of 1m over the existing 5-6m height is likely to be sufficient.
- The expected changes in the traffic noise on major roads remote from the portal areas as a result of the Project are considered to be minor and would not be generally noticeable from those documented in the EIS for the Reference Project.

### *Flora and Fauna*

- There would be very little change to vegetation areas to be cleared for the Project. While there is some extension to the proposed works along the southern side of the Western Freeway the footprint for the Project has been reduced within the area of Anzac Park.

### *Cultural Heritage*

- The Project will no longer impact on the locally registered Toowong Baptist Church, the Memorial Crows Ash or the locally registered Fig Trees along Kelvin Grove Road in McCaskie Park and the State registered Fig Trees in Marshall Park.
- The potential for cultural heritage impacts from the Project driven tunnels remain as identified in the EIS with the following clarifications and changes:
  - Forester's Hall, Latrobe Terrace Paddington (State significance) is not directly above the tunnel alignment but may be within the zone of affectation from tunnel vibration;
  - The Terrace Shops and Flats, 91-109 Musgrave Rd Red Hill (local significance) is beyond any likely zone of affectation from mainline tunnel vibration;
  - St Brigid's Convent, Upper Clifton Terrace Red Hill (State significance) is no longer directly above the Project mainline tunnel alignment but may be within the zone of affectation from tunnel vibration;
  - Gona Barracks (State significance)was incorrectly omitted from the EIS and is directly above the tunnel alignment; and

- Fig Trees, Kelvin Grove Rd opp. Normanby Hotel (State significance) are not directly above the tunnel alignment and not within potential zone of affectation from tunnel vibration. However the potential for impact from groundwater drawdown exists.

*Connectivity and residential impacts*

- The Project has no direct impact on existing or planned pedestrian crossing arrangements at the Milton Road/Croydon Street/Morley Street intersection or along Croydon Street.
- The removal of the connection will also avoid many of the operational impacts of the EIS Reference Project, including on local connectivity and community cohesion between neighbourhoods and to community facilities such as Toowong State School, local shops and public transport facilities. The removal of the connection will also avoid the partial loss of Quinn Park and impacts on amenity for park users.
- The removal of the connections at Toowong and Kelvin Grove will reduce the number of properties impacted by surface works, either wholly or in part, from 116 properties to 13 properties.

## 4.1 Traffic and Transport

The performance of the Project has been assessed in terms of traffic demands, access requirements, travel speed and travel time, intersection performance, and interaction with public transport and active transport. The effect on traffic and transport during the construction of the Project has also been identified. Cumulative effects with other projects have also been addressed.

The assessment has been carried out by comparing the performance of the Project to a future year scenario without Northern Link. Comparative data for the Northern Link EIS Reference Project, which includes connections to the Toowong and Kelvin Grove precincts in addition to the connections with the Western Freeway and the ICB, has also been tabulated for cross-reference.

The base future road networks have been updated to incorporate contemporary descriptions of key future projects, which date from after the EIS modelling was undertaken. Such projects include:

- Hale Street Link (HSL) – July 2008 Changed Project including Coronation Drive viaduct and right turn from Hale Street to Coronation Drive outbound;
- Coronation Drive – removal of tidal flow operation (as at October 2008) resulting in three traffic lanes inbound and two traffic lanes outbound;
- Airport Link – BrisConnections Conforming Design as per the Airport Link Request for Project Change (May 2008);
- Airport Roundabout Upgrade (ARU) – BrisConnections design including Fast Diamond interchange;
- Ipswich Motorway Upgrade – based on public information from DMR (2008); and
- Council Road Action Plan updates and updating of the expected timing of future network projects consistent with Council's programs.

Intersection improvements at the Milton Road/Croydon Street intersection (allowing right turn movements from Milton Road into Croydon Street) and Milton Road/Sylvan Road intersection (removal of the right turn from Milton Road to Sylvan Road with conversion to left-in left-out operation of Sylvan Road) at Toowong have been included in modelling of future network scenarios both without and with Northern Link. These improvements have been identified in Council's forward planning for a number of years as measures to improve safety and traffic operations in the local network and were included in the EIS traffic modelling.

As with the EIS Reference Project, reductions in surface road demands through the inner west area as a result of the Project would create the opportunity to provide for improved bus priority initiatives. Reductions in demand on the Coronation Drive corridor could allow for reallocation of lane designations to improve public transport operations. For example, an inbound bus lane or T3 lane could be designated between Toowong and Milton, west of Hale Street, with two general traffic lanes operating in each direction along Coronation Drive throughout the day. While a policy decision has yet to be made on an inbound bus lane or T3 lane, the opportunity to re-introduce bus priority on Coronation Drive has been included in the surface road network assumptions, and is supported by the submissions on the EIS. No other changes to the alternative surface road network with Northern Link have been assumed in the traffic modelling. For clarity the number of lanes along the key surface roads are summarised in **Table 4-1**.

**Table 4-1 Northern Link Project surface road network assumptions**

| Surface Road Segment | Number of lanes[1] |
|---|---|
| Centenary Highway & Western Freeway (northbound – Centenary Hwy/Ipswich Mwy interchange and Northern Link portal) | 2 lanes prior to 2016<br>2 lanes + T2 lane from 2016 (excluding bridge) |
| Centenary Highway & Western Freeway (southbound – between Northern Link portal and Centenary Hwy/Ipswich Mwy interchange) | 2 lanes prior to 2016<br>2 lanes + T2 lane from 2016 (excluding bridge) |
| Coronation Drive (eastbound) | 2 lanes + inbound bus[2] lane |
| Coronation Drive (westbound) | 2 lanes |
| Milton Road[3] (eastbound) | 2 lanes |
| Milton Road[3] (westbound) | 2 lanes |
| Inner City Bypass at Landbridge (eastbound) | 3 lanes |
| Inner City Bypass at Landbridge (westbound) | 3 lanes |

Table Notes:

1. The lane numbers listed above are typical general traffic through lanes for each road segment. The number of lanes does not include ancillary lanes at intersections (for example, turn pockets).

2. Coronation Drive has a total of 5 traffic lanes and since late 2008 operates with 3 traffic lanes inbound and 2 lanes outbound in the peak direction. Within the traffic modelling for the EIS Supplementary Report, an inbound bus lane has been assumed with Northern Link. This assumption allows maximum traffic impacts to be considered in the traffic model.

3. Model sensitivity testing indicates that similar strategic traffic impacts with the project would be expected if Coronation Drive were to operate with an inbound T3 lane and 2 traffic lanes in each direction.

4. Safety improvements at the Milton Road/Croydon Street intersection (allowing right turn movements from Milton Road into Croydon Street) and left-in left-out operation of Milton Road/Sylvan Road intersection have been assumed in modelling both without and with Northern Link.

Traffic modelling for the Northern Link Project has assumed a toll of $3.93 (expressed in 2008 dollars including GST) consistent with that applied for the EIS, although this will be subject to final approval.

An enhanced mode share effect for public transport (of approximately 11% of motorised trips by 2026) in the Brisbane Metropolitan area has been incorporated in the traffic forecasting for the Project consistent with the approach applied for the EIS.

### 4.1.1 Forecast Demand for Northern Link

**Table 4-2** summarises the forecast Northern Link traffic use for both the EIS Reference Project and the Project. Average weekday traffic flows of 34,200 vehicles per day in 2014 (after ramp up) and 48,800 vehicles per day in 2026 for the Northern Link Project are forecast. The Project would cater for approximately 34 to 39% less vehicles per day than the EIS Reference Project.

- **Table 4-2 Overall Traffic Use Summary – Northern Link EIS Project compared with Northern Link Project**

| **Project** [5] | | | | | |
|---|---|---|---|---|---|
| **Project Element** | **2014 Daily**[1] [2] | **2026 Daily**[1] | **2026 AM Peak vph** | **2026 PM Peak vph** | **2026 % CV**[3] |
| Eastbound tunnel | 18,400 | 26,400 | 2,300 | 2,000 | 6% |
| Westbound tunnel | 15,800 | 22,400 | 1,600 | 1,800 | 6% |
| Total Northern Link | **34,200** | **48,800** | **3,900** | **3,800** | **6.4%** |
| | | | | | |
| **EIS Reference Project** [5] | | | | | |
| **Project Element** | **2014 Daily**[1] [2] | **2026 Daily**[1] | **2026 AM Peak vph** | **2026 PM Peak vph** | **2026 % CV**[3] |
| Eastbound tunnel | 29,000 | 38,600 | 3,300 | 2,900 | 5% |
| Westbound tunnel | 26,900 | 35,900 | 2,400 | 3,000 | 6% |
| Total Northern Link | **55,800** | **74,500** | **5,700** | **5,900** | **5.5%** |
| | | | | | |
| **Percentage difference between Project and EIS Reference Project** | | | | | |
| **Project Element** | **2014 Daily**[1] [2] | **2026 Daily**[1] | **2026 AM Peak vph** | **2026 PM Peak vph** | |
| Eastbound tunnel | -37% | -32% | -30% | -31% | |
| Westbound tunnel | -41% | -38% | -33% | -40% | |
| Total Northern Link | **-39%** | **-34%** | **-32%** | **-36%** | |

Table source – Northern Link Traffic Model.

**Table Notes:**

1) Average Weekday Traffic Volumes.

2) 2014 model volumes exclude adjustment for ramp-up effects. At opening, volumes would be typically 70% of the traffic model forecast and these adjusted volumes are indicated in brackets below the modelled volume. Ramping up to the modelled 2014 volumes would typically occur over an 18 month to 2 year period.

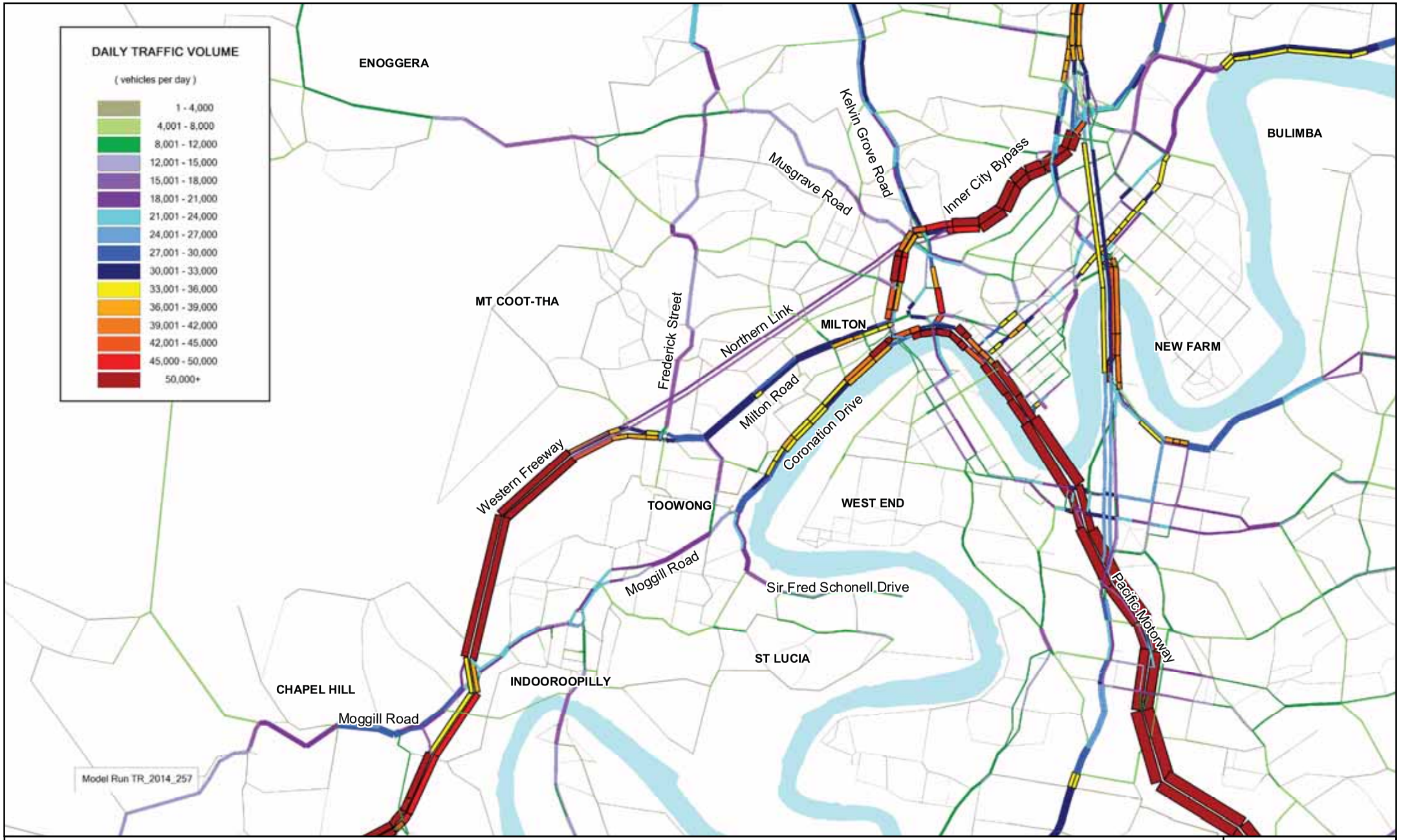
3) CV = medium and heavy commercial vehicles as per AustRoads Class 3 and above.

4) Forecast based on toll of $3.93 expressed in $2008 including GST.

5) Both the EIS Reference Project and the Project (without the local connections) are modelled with updated future base network projects.

The overall forecast network daily traffic demand for the Project in 2014 and 2026 is displayed in **Figure 4-1** and **Figure 4-2** respectively. Both of these figures display the volume of traffic that the Project would carry in relation to other major roads and in a regional context.

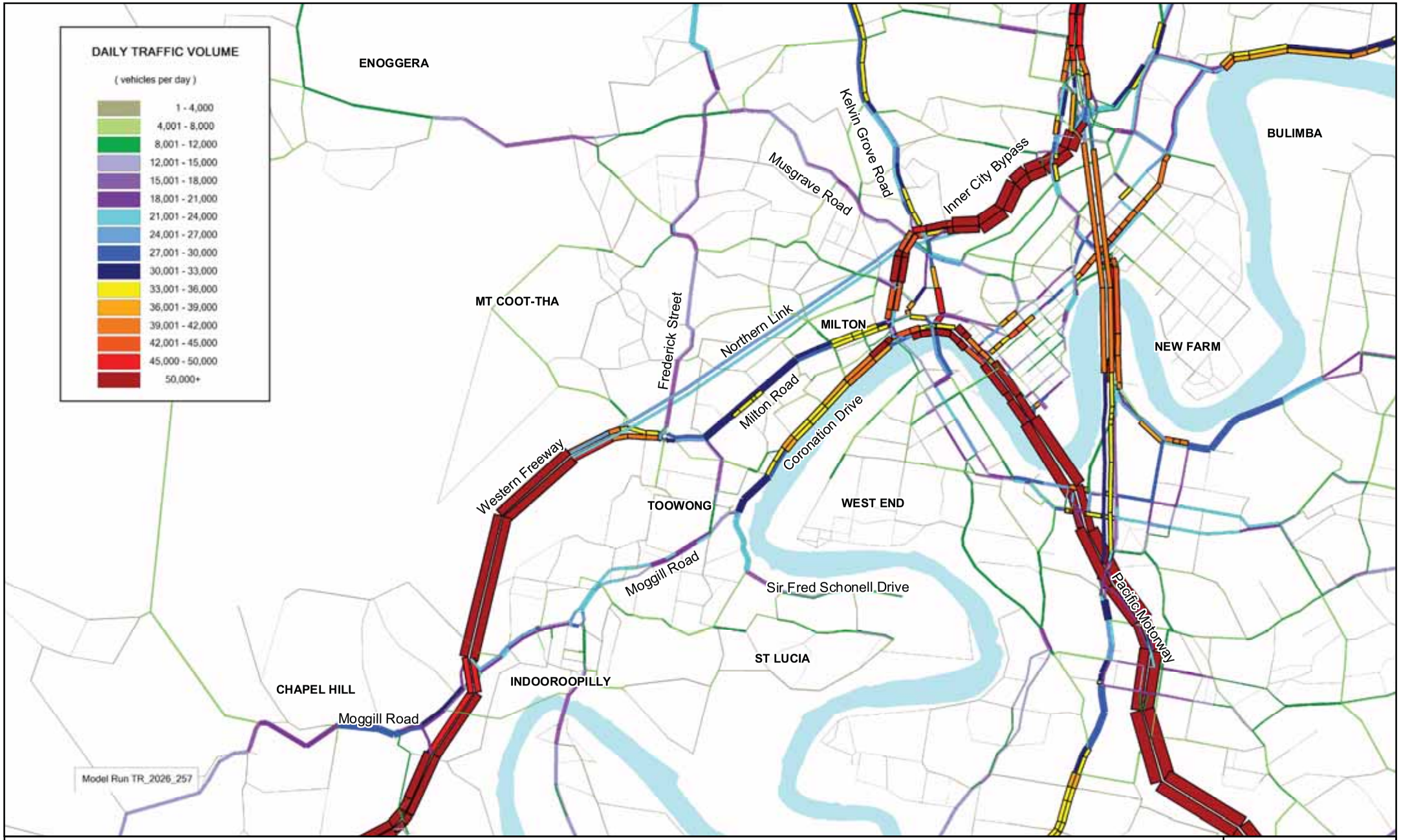
Tolling on Northern Link would discourage some potential users who judge that the travel time savings and other benefits provided by the facility would not equal or exceed the cost of the toll. Traffic modelling indicates that in 2014 approximately 33% of potential Project users would not be prepared to pay the toll (and would choose to remain on surface roads). However, as travel times on alternative routes increase, by 2026 this would decline to 24% as users perceive that greater benefits in travel time savings and reliability can be realised by using the toll road facility. These diversion rates are similar to that forecast for the EIS Reference Project.




NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT - SUPPLEMENTARY REPORT

Figure 4-1

**2014 Average Weekday Traffic Volume for the Project**




NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT - SUPPLEMENTARY REPORT

Figure 4-2

**2026 Average Weekday Traffic volume for the Project**

### 4.1.2 Function of Northern Link

To examine the traffic function of the Project an analysis of the forecast travel patterns and geographic distribution of travel has been undertaken. **Figure 4-3** shows the traffic routes for vehicles that would use the Northern Link tunnel. The forecast daily travel patterns are summarised in **Table 4-3.** The travel sectors are illustrated in Figure 5-1 of the EIS.

**Table 4-3 Daily Travel Patterns for the Northern Link Project Traffic (2026)**

| From \ To | Inner West | Central City | West Brisbane | Airport/ATC North/Eagle Farm | North Brisbane | South of Brisbane River | Total |
|---|---|---|---|---|---|---|---|
| Inner West | - | 1% | - | 1% | 4% | 2% | 8% |
| Central City | 1% | - | 1% | - | - | 3% | 5% |
| West Brisbane | - | 3% | - | 2% | 5% | 3% | 12% |
| Airport/ATC North/Eagle Farm | 1% | - | 2% | - | - | 11% | 14% |
| North Brisbane | 4% | - | 4% | - | - | 13% | 21% |
| South of Brisbane River | 2% | 6% | 2% | 12% | 15% | 3% | 40% |
| Total | 8% | 10% | 10% | 15% | 23% | 34% | 100% |

Table Key:

- Radial or CBD related travel
- Other Cross-City travel
- Cross City / Airport/ATC North travel
- Local travel

(x%) - % commercial vehicles

Source: Northern Link Traffic Model

**Table 4-4** provides a comparison of the trip type between the Project and the EIS Reference Project for all traffic and commercial vehicles.

**Table 4-4 Comparison of trip type for the Project and the EIS Reference Project (2026)**

| | Total average weekday traffic | | | | Commercial vehicles | | | |
|---|---|---|---|---|---|---|---|---|
| | Project | | EIS Reference Project | | Project | | EIS Reference Project | |
| Trip Type | Volume | Percent | Volume | Percent | Volume | Percent | Volume | Percent |
| Local travel | 0 | 0% | 100 | <1% | 0 | 0% | 0 | 0% |
| Radial or Central City (including CBD) related travel | 7,000 | 14% | 14,800 | 20% | 100 | 3% | 250 | 6% |
| Other cross city travel | 27,300 | 56% | 44,700 | 60% | 1,900 | 61% | 2,550 | 63% |
| Cross city / ATC North/Airport travel | 14,500 | 30% | 14,900 | 20% | 1,100 | 36% | 1,300 | 32% |
| **TOTAL** | **48,800** | **100%** | **74,500** | **100%** | **3,100** | **100%** | **4,100** | **100%** |

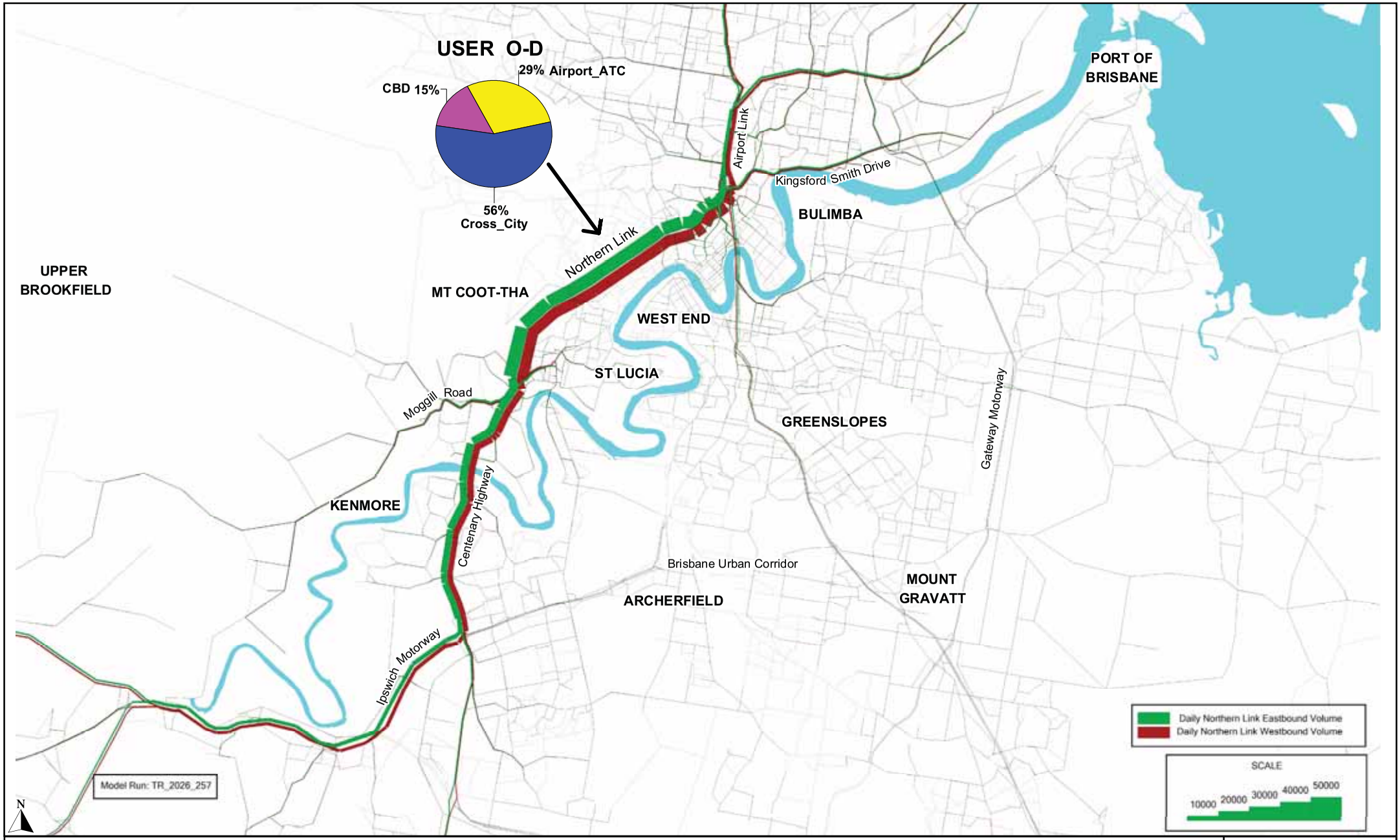
The analysis shows:

- The Project would predominantly carry cross city traffic, 86% of all trips including 30% of trips associated with travel to the ATC. This is a higher proportion of cross-city movements compared to the EIS Reference Project (80%), however the absolute number is less – 41,800 vpd compared to 59,600 vpd in 2026.
- The Project would provide access for some traffic to the northern end of the central city area. This would occur via the ICB and Bowen Bridge Road. This type of travel would account for approximately 14% of all trips through Northern Link compared with 20% of all trips for the EIS Reference Project. The overall number of these radial trips in 2026 would be about half compared to the EIS Reference Project as that project provided greater accessibility to the central city area due to the inclusion of the south facing ramps on Kelvin Grove Road.
- The Project would carry a higher proportion (6.4%) of commercial vehicle traffic than the EIS Reference Project (5.5%) in 2026. A similar quantum of commercial vehicles as reported for the EIS Reference Project (over 1,100 per day) would use Northern Link for travel to the ATC.

## Daily Travel Patterns

The overall daily travel patterns of the 48,800 vehicles per day in 2026 that would use the Project, shown in **Figure 4-3,** show that:

- For traffic accessing Northern Link from the Western Freeway, most traffic (60%) would travel via the Centenary Bridge from the Western Freeway with 19% and 17% accessing from Moggill Road west and east respectively. The remaining 3% would access from Fig Tree Pocket Road.
- For traffic accessing Northern Link from the eastern connection (ICB), over 50% would access via the Airport Link/Lutwyche Road corridor, 18% would continue eastwards on the ICB, 20% would access from the Herston, Bowen Hills and central city area and 8% would be associated with travel to/from CLEM7.




**LEGEND**

- Other Cross City travel
- Airport / ATC North travel
- Radial or CBD related travel

NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT - SUPPLEMENTARY REPORT

**Figure 4-3**

**2026 Daily Travel Patterns for the Project (Select Links)**

### 4.1.3 Function of the Project connections

**Table 4-5** details the overall forecast daily and peak hour traffic use of the Northern Link connections and ramps for both the EIS Reference Project and the Project.

- **Table 4-5 Northern Link Connections Traffic Summary – 2026 Average Weekday Traffic - The Project (ie. without local connections) compared with the EIS Reference Project.**

| Project Element | The EIS Reference Project Daily Traffic 2026 | The EIS Reference Project % of Daily Traffic | The Project Daily Traffic 2026 | % Change between Project and EIS Reference Project |
|---|---|---|---|---|
| Western Connections (on-ramps heading east) | | | | |
| Western Freeway (west facing on-ramp) | 27,900 | 72% | 26,400 | -5% |
| Milton Road (east facing on-ramp) | 1,000 | 3% | - | - |
| Croydon Street (east facing on-ramp) | 9,700 | 25% | - | - |
| Total Western Connection Traffic (on ramps) | 38,600 | 100% | 26,400 | -32% |
| Eastern Connection (off-ramps heading east) | | | | |
| ICB (east facing off-ramp) | 22,600 | 59% | 26,400 | +17% |
| Kelvin Grove Road (north facing off -ramp) | 7,500 | 19% | - | - |
| Kelvin Grove Road (south facing off -ramp) | 8,500 | 22% | - | - |
| Total Eastern Connection Traffic (off-ramps) | 38,600 | 100% | 26,400 | -32% |
| Eastern Connection (on-ramps heading west)) | | | | |
| ICB (east facing on-ramp) | 19,100 | 53% | 22,400 | +17% |
| Kelvin Grove Road (north facing on-ramp) | 8,500 | 24% | - | - |
| Kelvin Grove Road (south facing on-ramp) | 2,700 | 8% | - | - |
| Musgrave Road (south facing on-ramp) | 5,700 | 16% | - | - |
| Total Eastern Connection Traffic (on-ramps) | 36,000 | 100% | 22,400 | -38% |
| Western Connection (off-ramps heading west) | | | | |
| Western Freeway (west facing off-ramp) | 25,700 | 71% | 22,400 | -13% |
| Croydon Street (east facing off-ramp) | 10,300 | 29% | - | - |
| Total Western Connection Traffic (off-ramps) | 36,000 | 100% | 22,400 | -38% |

Table Source – Northern Link Traffic Model

**Table Notes:**

1) Forecast based on full journey toll of $3.93 and expressed in $2008 including GST.

At the Western Freeway connection, the Project would have 26,400 vehicles per day entering and 22,400 vehicles per day exiting in 2026. The Western Freeway on ramp would have a lower forecast volume than for the EIS Reference Project (-5%), due to the Project providing a slightly less attractive route from the west for some city bound trips. Without the Toowong ramps the total use of the tunnel heading east would be lower than forecast for the EIS Reference Project (-32%), due to the loss of local connectivity to the tunnel from the inner western suburbs and the use of the existing surface network. The Western Freeway off ramp would have an even lower forecast volume than for the EIS Reference Project (-13%) due to the effect from fewer vehicles using the Project as a return trip from the city due to the more difficult access from the city to the tunnel portals.

At the ICB connection, the Project would have 22,400 vehicles per day entering (heading west) and 26,400 vehicles per day exiting (heading east) in 2026, which is an increase in both directions of 17% compared to the EIS Reference Project. The Kelvin Grove Road ramps provided a more balanced distribution of the EIS

Reference Project tunnel traffic taking 47% into the tunnel and 49% out from the tunnel. Without the Kelvin Grove Road connection, all traffic using the Project will only be able to access and exit the tunnels from the ICB providing the increased use of the ICB portals (+17%) over the EIS Reference Project in order to access the northern end of the central city or suburbs such as Newmarket and Wilston.

It is also noted that the Project would have more vehicles heading east (26,400 vpd in 2026, than would be heading west (22,400 vpd in 2026). The likely reason for this is that the Project would still provide an attractive potential to access the city from the west, however a number of return trips (4,000 vpd) would view the existing surface network as a more desirable option than accessing the ICB on ramp from the city.

### 4.1.4 Traffic Volume Effects on Regional and Connecting Roads and Intersections

Forecast changes in weekday traffic volume for the Project on the regional road network are presented in **Table 4-6** and illustrated in **Figure 4-4**. **Table 4-7** provides a comparison of traffic volumes on the regional road network between the EIS Reference Project and the Project.

**Table 4-6** and **Table 4-7** as well as **Figure 4-4** show that the major component of the traffic function of the Project would be associated with strategic and intra regional travel, consistent with the travel pattern analysis. As with the EIS Reference Project, traffic volume effects are forecast beyond the corridor due to regional traffic re-distributing to alternative routes to access the facility, and in some situations these offer beneficial reductions in total traffic use of regional routes.

Key findings on the regional road network traffic volume effects indicated by tables 4-6 and 4-7 and Figure 4-4 are:

- Beyond the immediate area of the Project, few key routes experience significant traffic increases compared to the scenario without the Project.
- A small increase, shown in Table 4-6, in overall traffic within the Airport Link/Lutwyche Road corridor (of approximately +6% in 2026) is indicated (a similar effect to the EIS Reference Project).
- A small reduction (-6% in 2026) in traffic use of Hale Street Link is forecast with the Project, with the Project reinforcing the use of the motorway standard links using ICB and CLEM7 for longer distance cross-river travel (a similar effect to the EIS Reference Project).
- Traffic volumes on the Walter Taylor Bridge in Indooroopilly are not significantly changed by the Project, (+1% in 2026), where some users of this link would re-distribute to travel via the Western Freeway and Northern Link rather than the Moggill Road corridor (a similar effect to the EIS Reference Project).
- Sound traffic relief would be expected on some regional traffic corridors to the south, particularly by 2026 (when decreases of -10% to -18% are forecast), including the Ipswich Motorway east of the Centenary Highway (-10%), CLEM7 (-11%), Ipswich Road and Fairfield Road (-18%). Reductions on these routes are not as large as forecast for the EIS Reference Project, however, because with removal of the Kelvin Grove Road connections some trips diverted from these routes are not served by the Project.
- A minimal amount of traffic relief is offered to the Riverside Expressway (-1%), and through routes in the CBD such as Ann and Turbot Streets.
- Traffic reductions are forecast on the congested MetRoad 5 corridor, examples at 2026 include Frederick Street (-9%) and Jubilee Terrace (-5%) due to increased connectivity for cross-city travel via Northern Link. However, the reduction of traffic using the MetRoad 5 corridor is less for the Project than for the EIS Reference Project. This is due to the lack of accessibility to Northern Link for trips from the Toowong area with the Project.

- The Logan Motorway, would experience a small traffic reduction, -2% in 2014 and -1% in 2026 (similar to the EIS Reference Project).
- Negligible change in traffic use of the Gateway Bridge is forecast (<1%).

### Traffic Volume Effects on Connecting Roads

The forecast effect on average weekday daily traffic volumes on connecting roads for the years 2014 and 2026 and the percentage change, without and with the Project, is summarised in **Table 4-8**. The forecast traffic volume changes with the Project compared to the scenario without the project are illustrated in **Figure 4-4** for 2026. **Table 4-9** provides a comparison of the effect on connecting roads between the EIS Reference Project and the Project. This generally shows that the EIS Reference Project is forecast to have a greater effect on connecting roads than the Project. Examples of such roads include the Western Freeway, Croydon Street, Jephson Street, Burns Road, Kelvin Grove Road, Musgrave Road, College Road and Petrie Terrace. The major exception to this is the Inner City Bypass (ICB).

The Project has the following effects on connecting roads at the western end of the Project:

- The forecast overall increase of daily traffic on the Western Freeway-Centenary Highway corridor for the Project is marginally less (1%) than for the EIS Reference Project.
- Average weekday traffic on the Western Freeway north of Moggill Road is forecast to reach 113,600 vpd with the Project. By 2026, an increase in traffic to 136,700 vehicles per day is forecast, representing a 31% increase compared to the without Project scenario.
- The Project has an increased impact at the connection of the Western Freeway to Moggill Road compared to the EIS Reference Project. The Project increases volumes through the signalised intersections at the Western Freeway on and off ramps at Moggill Road by approximately 5% and 13% in the AM and PM peaks respectively in 2014 compared to the scenario without Northern Link. By comparison, the EIS Reference Project has negligible change on volumes in the AM peak and a 7% increase in volumes in the PM peak. The changes with the Project arise because without a Toowong local connection increased use of Moggill Road west of Indooroopilly to access Northern Link via the Western Freeway is forecast. Potential users of Northern Link from Taringa, Indooroopilly and St Lucia would utilise this route. The forecast daily traffic increase on Moggill Road between Indooroopilly and the Western Freeway is 3% in 2014 and 4% in 2026, compared to a small reduction in traffic in this route with the EIS Reference Project. During peak periods the effect would mainly occur in the counter-peak direction (e.g. outbound in the AM peak).

To examine peak period traffic operations at the connections of the Project to the Western Freeway, and at the Moggill Road interchange ramps and intersections, dynamic modelling using the Paramics micro-simulation software has been undertaken to provide detailed assessment of the traffic operations at the Project connections and assist in the identification of mitigation measures, as appropriate. Results of the micro-simulation modelling are tabulated in **Table 4-10** and **Table 4-11** for 2014 and 2026 respectively.

The micro-simulation modelling has found that a satisfactory level of service (LOS) of operation of the existing 4-lane roadway at merge and diverges zones (i.e. LoS B to C) is forecast upon opening of Northern Link (2014) with the implementation of some mitigation works at the entry and exit ramps to the Western Freeway from Moggill Road. Mitigations are discussed further below. Modelling has also confirmed that implementation of the State's SEQIPP transit lane project (or similar) in the 2016 to 2026 time-frame would result in a satisfactory level of service of operation for the longer term (2026) time horizon.

Based upon the micro-simulation analysis of opening year operations (i.e. prior to any increase in lane capacity on the Western Freeway) implementation of the following mitigation works is recommended:

- Upgrading of the existing single lane exit from the Western Freeway southbound to Moggill Road to provide a 300 metre auxiliary lane allowing a 2 lane exit to the existing ramp. With this mitigation, a satisfactorily level of service of operation of the diverge from the freeway to the Moggill Road exit (Level of Service B to C) is forecast in 2014 with the increased traffic associated with the Northern Link Project.
- Extending the existing northbound auxiliary lane from the Moggill Road on-ramp to the Western Freeway by approximately 450 metres, effectively creating a third inbound lane on the Western Freeway to the Waverley Road over-bridge. With this mitigation, a satisfactorily level of service of operation of the merge to the freeway from the Moggill Road entry (Level of Service C) is forecast in 2014 with the increased traffic associated with the Northern Link Project.

The results of SIDRA intersection analysis for the Western Freeway ramp intersections with Moggill Road are summarised in **Table 4-12**. These tables show that the forecast level of service of operation of the signalised intersections would be LoS C in both 2014 and 2026 in both the AM and PM peaks, although a high degree of saturation is forecast for right turn movements from Moggill Road to the northbound on-ramp which experienced increased demand due to the Project. The micro-simulation modelling (refer **Table 4-10**) confirms that these intersections, and queues between the closely spaced intersections, could be satisfactorily managed with signal co-ordination in early years post Northern Link opening with the forecast traffic volumes. Ultimately upgrades to the interchange configuration at Moggill Road are anticipated in association with upgrading of the Centenary Motorway with implementation of the State's SEQIPP transit lane project (or similar) in the 2016 to 2026 time-frame and in association with any future WBTNI connection within the Western Freeway.

Further west along the connecting route along Centenary Highway corridor an increase of 9% in 2014 and 14% in 2026 is forecast at the Centenary Bridge. This is 2 to 3% lower than the impact forecast with the EIS Reference Project. The effect of the Project at other interchanges along the Centenary Highway corridor south of Moggill Road has been considered by undertaking a detailed comparison of ramp volumes for both the Project, compared to the scenario without the Project. This is provided in the response to EIS submissions in **Appendix B.5.6, Issue 7 – No widening of Western Freeway.** This assessment demonstrates that the Project does not significantly increase traffic volumes through any of the surface interchanges. In some cases surface interchange volumes along the Centenary Highway are reduced due to lower flows on south facing ramps. While increases on individual on and off ramps occur, the peak hour ramp volumes are within link capacities and no mitigation measures are necessary on the Centenary Highway interchanges south of Moggill Road due to the Project.

East of the Northern Link connections to the Western Freeway (i.e. approaching the roundabouts) operating conditions would improve with the Project. This is because approximately 35% of the traffic using the Western Freeway would divert to Northern Link and there would be a substantial reduction in volume of Western Freeway traffic that would pass through the congested Mt Coot-tha and Toowong roundabouts linking to Milton Road and MetRoad 5. This would generally improve travel conditions for commuter and local traffic use of this part of the network, and relieve pressure for use of local network for extraneous through traffic use of local roads (rat-running). At the roundabouts a level of service B is forecast with the project in 2026, a significant improvement compared to current conditions.

In the Toowong area, with removal of the local connection, several roads that provided connectivity to the EIS Reference Project would have reductions in traffic compared to the scenario without Northern Link. Key

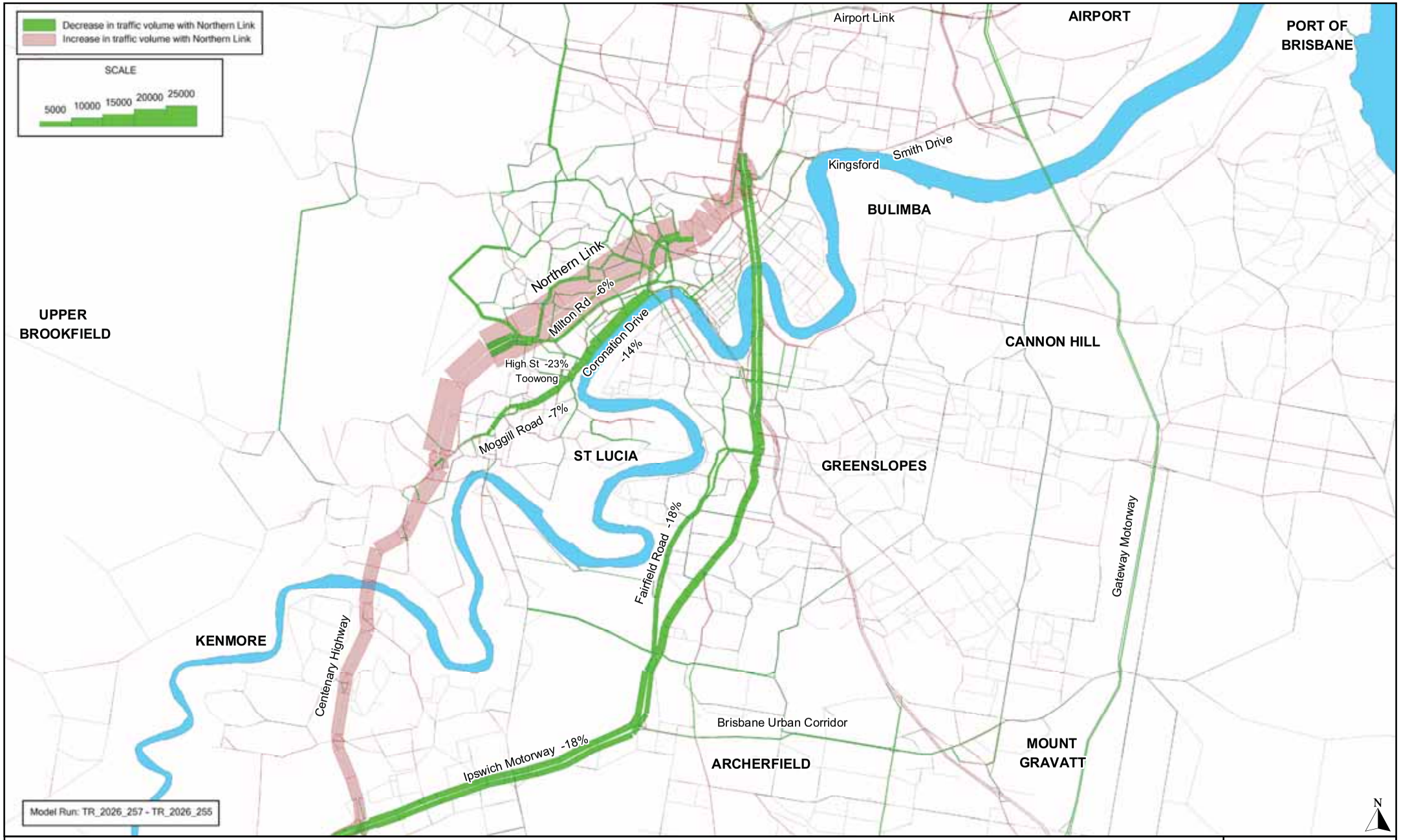
examples of traffic reductions include Jephson Street (-4%), Sylvan Road (-10%), Burns Road (-4%) and Morley Street (-11%), which are forecast to experience reduction in average weekday traffic in 2026 compared to the scenario without Northern Link. By comparison, some of these roads had increases in traffic with the EIS Reference Project.

The Project has the following effects on connecting roads at the eastern end of the Project:

- On the 6-lane Inner City Bypass, immediately west of the Northern Link ramps, increases in average weekday traffic in the order of 30% (compared to the without Northern Link scenario) are forecast resulting in 153,500 vehicles per average weekday by 2026. Due to the orbital function of this motorway standard connection, traffic volumes during peak periods are quite balanced and the distribution of traffic throughout the day leads to a flat demand profile, rather than pronounced commuter peaks. A satisfactory level of service of operation of B to C, based upon the findings of micro-simulation modelling, is forecast during peak periods as detailed in **Table 4-10**.
- On the Inner City Bypass the forecast increase in traffic for the Project is 5,000 vehicles per day in 2014 and 10,000 vehicles per day greater than the EIS Reference Project in 2026. In addition to micro-simulation modelling (as reported in **Table 4-10**) detailed analysis of ramp volumes and intersection operations at the connections between the ICB route and Bowen Bridge Road-Lutwyche Road has been undertaken for the Project to assess these impacts.
- Connections to the Inner City Bypass at Bowen Hills, providing routes between the Project and the Central City, would experience traffic increases (as reported in **Table 4-8**). Usage of the Inner City Bypass off-ramp to Herston Road, in particular, would increase substantially by approximately 126%, and traffic volumes using the north-facing multi-function on-ramp from Bowen Bridge Road to Airport Link, CLEM7 and the ICB would increase by approximately 20%. Peak and daily volumes on these ramps, however, remain within their traffic carrying capacity. Specific details on ramp utilisation are also provided in the response to the EIS submissions in **Appendix B.5.6, Issue 6 – Inner City Bypass Capacity**.
- The analysis of the effects of the Project on the intersections along the network further east along the Inner City Bypass to Bowen Bridge Road-Lutwyche Road route has been undertaken and the results of SIDRA analysis are provided in **Table 4-12.**
- Modest traffic increases would be experienced on Herston Road and Bowen Bridge Road feeding the Inner City Bypass ramps. Analysis of the key intersections in this area for peak periods in 2026 indicates that the impact on performance would generally be small. At Bowen Bridge Road / Herston Road, small increases in average delay are forecast, but Level of Service would not be affected. At Bowen Bridge Road / Butterfield Street, the change in PM peak traffic flows through the intersection would be small (approximately 1%), and satisfactory level of service is forecast during peak periods even with the increased flow to the AL/CLEM7/ICB on-ramp.
- North of Butterfield Street, at the key intersections along Lutwyche Road at Northey Street and Gallway Street the impact of the Project would be very similar to the EIS Reference Project. The forecast volumes are expected to be within the capacity of the planned road configurations, and at critical intersections similar overall performance compared to the scenario without Northern Link is forecast.
- Overall, traffic volume changes with the Project can be satisfactorily accommodated within the planned interchange and intersection arrangements in the Bowen Hills area that will be implemented with the CLEM7, Airport Link and Northern Busway projects.
- In the Kelvin Grove area, with removal of the local connection, several roads that provided connectivity to the EIS Reference Project would have reductions in traffic compared to the scenario without Northern Link. Key examples of traffic reductions include Kelvin Grove Road (-3% to -7%), Musgrave Road (-9%),

College Road (-1%), Petrie Terrace (-10%) and Countess Street (-7%) which are forecast to experience reduction in average weekday traffic in 2026 compared to the scenario without Northern Link. By comparison, these roads were forecast to experience increases in traffic with the EIS Reference Project.

In summary, the assessment indicates that no specific broader road network upgrades to mitigate congestion points with the Project operational are triggered, although it is noted that an underlying assumption incorporated with the traffic modelling is that implementation of the Western Freeway-Centenary Highway transit lane project identified within SEQIPP occurs, and that this is operational in the period 2016 to 2026. No modifications would be needed on access and link roads to the Project to ensure its effective operation at opening.




**LEGEND**

**X %** **Traffic Reductions on Surface Public Transport Corridors**

NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT - SUPPLEMENTARY REPORT

**Figure 4-4**

**2026 Traffic volume changes compared to Base Case with the Project**

- **Table 4-6 Volumes on Key Surface Roads in the Regional Network – With and Without the Project**

| Road | Location | Average Weekday Traffic | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2014 | | | 2026 | | |
| | | 2007 | Without NL | With NL | % Difference | Without NL | With NL | % Difference |
| **State Strategic Roads** | | | | | | | | |
| Centenary Highway | Centenary Bridge | 86,800 | 100,000 | 109,000 | +9% | 119,200 | 135,300 | +14% |
| Western Freeway | South of Mt Coot-tha Road | 76,500 | 91,000 | 113,600 | +25% | 104,500 | 136,700 | +31% |
| Ipswich Mwy | at Oxley Creek, Oxley | 93,700 | 121,500 | 112,600 | -7% | 142,700 | 127,900 | -10% |
| Logan Mwy | at Oxley Creek, Larapinta | 23,500 | 44,400 | 43,600 | -2% | 74,600 | 73,500 | -1% |
| Kessels Road | E of Lowndes Street, Coopers Plains | 62,300 | 69,500 | 68,300 | -2% | 70,200 | 68,400 | -3% |
| Gateway Mwy | at Gateway Bridge | 105,800 | 168,800 | 169,400 | 0% | 238,300 | 236,800 | -1% |
| Airport Link | in Main Line Tunnel | X | 81,100 | 79,800 | -2% | 101,200 | 101,300 | 0% |
| East-West Arterial | E of Widdop Street | 28,800 | 80,700 | 80,400 | 0% | 118,900 | 119,500 | +1% |
| **Regional Radial Roads** | | | | | | | | |
| Pacific Mwy | at Captain Cook Bridge | 164,000 | 165,400 | 165,900 | 0% | 169,600 | 169,100 | 0% |
| Riverside Expressway | N of the Merivale Bridge | 96,000 | 98,900 | 96,800 | -2% | 101,300 | 100,100 | -1% |
| Kelliher Road | S of Ipswich Mwy, Darra | 36,200 | 37,600 | 37,700 | 0% | 82,800 | 84,700 | +2% |
| CLEM7 | at Brisbane River | X | 70,900 | 65,900 | -7% | 92,300 | 82,000 | -11% |
| ICB | Land Bridge | 79,200 | 109,300 | 130,800 | +20% | 117,800 | 153,500 | +30% |
| Hale Street Link | at Brisbane River | X | 18,100 | 18,800 | +4% | 25,400 | 24,000 | -6% |
| Gympie Road | N of Broughton Road, Kedron | 63,400 | 92,700 | 93,600 | +1% | 102,700 | 103,800 | +1% |
| Lutwyche Road | N of Stoneleigh Street, Lutwyche | 60,600 | 44,300 | 46,400 | +5% | 45,100 | 47,700 | +6% |
| Kingsford Smith Drive | E of Cooksley Street, Hamilton | 62,400 | 65,800 | 66,300 | +1% | 71,900 | 72,300 | +1% |
| **Regional Ring Roads** | | | | | | | | |
| Stafford Road | E of Beaconsfield Terrace, Kedron | 19,200 | 36,900 | 37,500 | +2% | 41,700 | 42,600 | +2% |
| Coonan Street | at Walter Taylor Bridge | 32,500 | 33,800 | 33,600 | -1% | 33,700 | 34,000 | +1% |
| Ipswich Road | N of Gainsborough Street, | 31,800 | 47,400 | 39,000 | -18% | 56,600 | 46,300 | -18% |

| Road | Location | Average Weekday Traffic | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2014 | | | 2026 | | |
| | | | Without NL | With NL | % Difference | Without NL | With NL | % Difference |
| | Moorooka | | | | | | | |
| Jubilee Terrace | N of Coopers Camp Road, Ashgrove | 27,700 | 30,000 | 28,800 | -4% | 31,900 | 30,200 | -5% |
| **City Distributor Roads** | | | | | | | | |
| Fairfield Road | N of Sherwood Road, Yeerongpilly | 17,400 | 22,300 | 21,500 | -4% | 30,800 | 25,300 | -18% |

Table Source – Northern Link Traffic Model

- **Table 4-7 Volumes on Key Surface Roads in the Regional Network - The Project compared with the EIS Reference Project**

| Road | Location | Average Weekday Traffic | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2014 | | | 2026 | | |
| | | 2007 | EIS Project | Project | % Change | EIS Project | Project | % Change |
| **State Strategic Roads** | | | | | | | | |
| Centenary Highway | Centenary Bridge | 86,800 | 111,400 | 109,000 | -2% | 139,200 | 135,300 | -3% |
| Western Freeway | South of Mt Coot-tha Road | 76,500 | 114,400 | 113,600 | -1% | 138,000 | 136,700 | -1% |
| Ipswich Mwy | at Oxley Creek, Oxley | 93,700 | 109,900 | 112,600 | +2% | 123,900 | 127,900 | +3% |
| Logan Mwy | at Oxley Creek, Larapinta | 23,500 | 43,600 | 43,600 | 0% | 73,000 | 73,500 | +1% |
| Kessels Road | E of Lowndes Street, Coopers Plains | 62,300 | 68,400 | 68,300 | 0% | 68,100 | 68,400 | 0% |
| Gateway Mwy | at Gateway Bridge | 105,800 | 168,600 | 169,400 | 0% | 237,400 | 236,800 | 0% |
| Airport Link | in Main Line Tunnel | X | 78,500 | 79,800 | +2% | 98,800 | 101,300 | +3% |
| East-West Arterial | E of Widdop Street | 28,800 | 81,400 | 80,400 | -1% | 120,100 | 119,500 | 0% |
| **Regional Radial Roads** | | | | | | | | |
| Pacific Mwy | at Captain Cook Bridge | 164,000 | 165,600 | 165,900 | 0% | 168,800 | 169,100 | 0% |
| Riverside Expressway | N of the Merivale Bridge | 96,000 | 98,200 | 96,800 | -1% | 99,200 | 100,100 | +1% |
| Kelliher Road | S of Ipswich Mwy, Darra | 36,200 | 37,800 | 37,700 | 0% | 84,800 | 84,700 | 0% |
| CLEM7 | at Brisbane River | X | 66,700 | 65,900 | -1% | 80,100 | 82,000 | +2% |
| ICB | Land Bridge | 79,200 | 125,200 | 130,800 | +4% | 142,800 | 153,500 | +7% |
| Hale Street Link | at Brisbane River | X | 18,800 | 18,800 | 0% | 23,900 | 24,000 | 0% |
| Gympie Road | N of Broughton Road, Kedron | 63,400 | 92,900 | 93,600 | +1% | 102,900 | 103,800 | +1% |
| Lutwyche Road | N of Stoneleigh Street, Lutwyche | 60,600 | 46,400 | 46,400 | 0% | 47,700 | 47,700 | 0% |
| Kingsford Smith Drive | E of Cooksley Street, Hamilton | 62,400 | 66,500 | 66,300 | 0% | 72,100 | 72,300 | 0% |
| **Regional Ring Roads** | | | | | | | | |
| Stafford Road | E of Beaconsfield Terrace, Kedron | 19,200 | 36,800 | 37,500 | +2% | 41,700 | 42,600 | +2% |
| Coonan Street | at Walter Taylor Bridge | 32,500 | 33,600 | 33,600 | 0% | 33,700 | 34,000 | +1% |
| Ipswich Road | N of Gainsborough Street, | 31,800 | 37,100 | 39,000 | +5% | 43,700 | 46,300 | +6% |

| Road | Location | Average Weekday Traffic | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2014 | | | 2026 | | |
| | | | EIS Project | Project | % Change | EIS Project | Project | % Change |
| | Moorooka | | | | | | | |
| Jubilee Terrace | N of Coopers Camp Road, Ashgrove | 27,700 | 26,500 | 28,800 | +9% | 27,900 | 30,200 | +8% |
| **City Distributor Roads** | | | | | | | | |
| Fairfield Road | N of Sherwood Road, Yeerongpilly | 17,400 | 20,500 | 21,500 | +5% | 23,500 | 25,300 | +8% |

## Table 4-8 Volumes on Key Connecting Roads – With and Without the Project

| Reporting Point | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2014 | | | 2026 | | |
| | | | | Without NL | With NL | % Difference | Without NL | With NL | % Difference |
| Western Connection | | | | | | | | | |
| A | Western Freeway | South of Mt Coot-tha Road | 76,500 | 91,000 | 113,600 | +25% | 104,500 | 136,700 | +31% |
| BB | Centenary Bridge | | 86,800 | 100,000 | 109,000 | +9% | 119,200 | 135,300 | +14% |
| 39 | Croydon Street | South of Milton Road | 12,000 | 30,400 | 32,500 | +7% | 29,700 | 31,000 | +4% |
| 36 | Morley Street | North of Milton Road | 3,900 | 7,700 | 4,700 | -39% | 6,200 | 5,500 | -11% |
| S | Jephson Street | North of Sherwood Road | 13,000 | 23,700 | 24,000 | +1% | 25,000 | 24,100 | -4% |
| W | Sylvan Road | South of Croydon Street | 10,900 | 13,200 | 13,100 | -1% | 14,900 | 13,400 | -10% |
| 4 | Burns Road | East of railway | 4,400 | 5,600 | 5,300 | -5% | 5,700 | 5,500 | -4% |
| **Eastern Connection** | | | | | | | | | |
| R | ICB | Land Bridge | 79,200 | 109,307 | 130,806 | +20% | 117,826 | 153,538 | +30% |
| DD | Kelvin Grove Road | South of Blamey Street | 53,000 | 50,500 | 51,500 | +2% | 59,600 | 58,000 | -3% |
| T | Kelvin Grove Road | North of School Road | 50,500 | 45,400 | 47,800 | +5% | 52,600 | 53,500 | +2% |
| 27 | Kelvin Grove Road | South of Ithaca Street | 35,300 | 36,000 | 35,200 | -2% | 40,400 | 38,000 | -6% |
| 25 | Kelvin Grove Road | off ramp to College Road | 5,000 | 8,900 | 8,000 | -10% | 9,800 | 9,100 | -7% |
| 23 | College Road | East of 5 ways | 31,600 | 43,600 | 41,600 | -5% | 48,900 | 48,200 | -1% |
| 24 | Musgrave Road | West of 5 ways | 32,900 | 36,600 | 33,800 | -8% | 39,600 | 36,100 | -9% |
| 26 | Petrie Terrace | South of 5 ways (one-way northbound) | 12,900 | 16,100 | 13,200 | -18% | 21,200 | 19,000 | -10% |
| 22 | Countess Street | South of College Road (one-way southbound) | 37,300 | 38,400 | 37,400 | -3% | 40,200 | 37,200 | -7% |
| 40 | Musgrave Road loop to NL, KGR and ICB | West of Hale Street (one-way from Musgrave Road) | 5,000 | 6,500 | 5,900 | -9% | 8,100 | 7,500 | -7% |
| - | ICB | Off Ramp to Herston Road | 4,700 | 4,200 | 9,200 | +119% | 4,800 | 10,800 | +126% |
| - | Herston Road | Near Bowen Bridge Road | 13,000 | 10,700 | 15,300 | +43% | 12,400 | 17,600 | +42% |
| - | Bowen Bridge Road | South of Herston Road | 76,400 | 53,500 | 55,600 | +4% | 56,700 | 59,600 | +5% |

| Reporting Point | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2014 | | | 2026 | | |
| | | | | Without NL | With NL | % Difference | Without NL | With NL | % Difference |
| - | Bowen Bridge Road | South of Butterfield Street | 62,400 | 52,400 | 53,200 | +2% | 59,300 | 60,500 | +2% |
| - | Bowen Bridge Road | On-ramp from Bowen Bridge Road to Airport Link, CLEM7 and Inner City Bypass | N/A | 9,800 | 12,100 | +23% | 14,000 | 16,800 | +20% |

Source - Northern Link Traffic Model

- **Table 4-9 Volumes on Key Connecting Roads to the Project – The Project compared with the EIS Reference Project**

| Reporting Point | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2014 | | | 2026 | | |
| | | | | EIS Project | Project | % Change | EIS Project | Project | % Change |
| Western Connection | | | | | | | | | |
| A | Western Freeway | South of Mt Coot-tha Road | 76,500 | 114,400 | 113,600 | -1% | 138,000 | 136,700 | -1% |
| BB | Centenary Bridge | | 86,800 | 111,400 | 109,000 | -2% | 139,200 | 135,300 | -3% |
| 39 | Croydon Street | South of Milton Road | 12,000 | 42,700 | 32,500 | -24% | 44,900 | 31,000 | -31% |
| 36 | Morley Street | North of Milton Road | 3,900 | 3,800 | 4,700 | +24% | 4,600 | 5,500 | +20% |
| S | Jephson Street | North of Sherwood Road | 13,000 | 27,200 | 24,000 | -12% | 29,600 | 24,100 | -19% |
| W | Sylvan Road | South of Croydon Street | 10,900 | 13,200 | 13,100 | -1% | 12,100 | 13,400 | +11% |
| 4 | Burns Road | East of railway | 4,400 | 6,000 | 5,300 | -12% | 6,400 | 5,500 | -14% |
| **Eastern Connection** | | | | | | | | | |
| R | ICB | Land Bridge | 79,200 | 125,200 | 130,800 | +4% | 142,800 | 153,500 | +7% |
| DD | Kelvin Grove Road | South of Blamey Street[(1)] | 53,000 | 60,600 | 51,500 | -15% | 68,200 | 58,000 | -15% |
| T | Kelvin Grove Road | North of School Road | 50,500 | 52,800 | 47,800 | -9% | 59,800 | 53,500 | -11% |
| 27 | Kelvin Grove Road | South of Ithaca Street | 35,300 | 37,900 | 35,200 | -7% | 40,200 | 38,000 | -5% |
| 25 | Kelvin Grove Road | off ramp to College Road | 5,000 | 10,300 | 8,000 | -22% | 12,200 | 9,100 | -25% |
| 23 | College Road | East of 5 ways | 31,600 | 46,700 | 41,600 | -11% | 55,100 | 48,200 | -13% |
| 24 | Musgrave Road | West of 5 ways | 32,900 | 37,900 | 33,800 | -11% | 41,500 | 36,100 | -13% |
| 26 | Petrie Terrace | South of 5 ways (one-way northbound) | 12,900 | 13,500 | 13,200 | -2% | 19,100 | 19,000 | -1% |
| 22 | Countess Street | South of College Road (one-way southbound) | 37,300 | 38,400 | 37,400 | -3% | 39,500 | 37,200 | -6% |
| 40 | Musgrave Road loop to NL, KGR and ICB | West of Hale Street (one-way from Musgrave Road) | 5,000 | 9,300 | 5,900 | -37% | 12,500 | 7,500 | -40% |
| - | ICB | Off Ramp to Herston Road | 4,700 | 7,000 | 9,200 | +30% | 7,700 | 10,800 | +41% |
| - | Herston Road | Near Bowen Bridge Road | 13,000 | 13,500 | 15,300 | +13% | 14,800 | 17,600 | +19% |
| - | Bowen Bridge Road | South of Herston Road | 76,400 | 53,200 | 55,600 | +5% | 57,600 | 59,600 | +4% |

| Reporting Point | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2014 | | | 2026 | | |
| | | | | EIS Project | Project | % Change | EIS Project | Project | % Change |
| - | Bowen Bridge Road | South of Butterfield Street | 62,400 | 51,100 | 53,200 | +4% | 59,800 | 60,500 | +1% |
| - | Bowen Bridge Road | On-ramp to Airport Link, CLEM7 and Inner City Bypass | N/A | 10,600 | 12,100 | +14% | 14,500 | 16,800 | +16% |

Source - Northern Link Traffic Model

## Table 4-10 Traffic Performance on Connecting Links to Northern Link Project (2014)

| Road Network Element | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| | Eastbound | | Westbound | | Eastbound | | Westbound | |
| | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) |
| Northern Link | | | | | | | | |
| Tunnel | 80 | A | 80 | A | 80 | A | 80 | A |
| Eastern Connection at Inner City Bypass | | | | | | | | |
| Inner City Bypass east of NL connections (i.e. at Landbridge) | 68 | B | 64 | B | 65 | B | 71 | B |
| Inner City Bypass west of NL connection (i.e. from Kelvin Grove Road entry & Hale Street) | 65 | B | - | - | 59 | B | - | - |
| Inner City Bypass west of NL connection (i.e. towards Ithaca Street exit & Hale Street) | - | - | 55 | C | - | - | 71 | B |
| Western Connection at Western Freeway(4) | | | | | | | | |
| Western Freeway east of tunnel portal (i.e. towards Mt Coot-tha Road) | 80 | A | 70 | B | 80 | A | 66 | B |
| Western Freeway at Northern Link diverge zone | 70 | B | - | - | 75 | B | - | - |
| Western Freeway at Northern Link merge zone | - | - | 67 | B | - | - | 52 | C |
| Western Freeway at Moggill Road on ramp merge zone | 58 | C | - | - | 61 | C | - | - |
| Western Freeway at Moggill Road off ramp diverge zone | - | - | 68 | B | - | - | 47 | C |
| Western Freeway at Moggill Road bridge | 71 | B | 87 | A | 87 | A | 65 | B |
| Moggill Road on-ramp | 46 | C | - | - | 50 | C | - | - |
| **Moggill Road/ Western Freeway southbound off–ramp intersection** | | | | | | | | |
| | AM Peak | | | | PM Peak | | | |
| | Av Delay (s) | LoS(5) | | | Av Delay (s) | LoS(5) | | |
| Moggill Road west | 25 | C | | | 14 | B | | |
| Western Freeway off-ramp | 19 | B | | | 22 | C | | |
| Moggill Road east | 11 | B | | | 46 | D | | |
| Overall Intersection | **20** | **C** | | | **33** | **C** | | |
| **Moggill Road/ Western Freeway northbound on- ramp intersection** | | | | | | | | |
| Moggill Road west | 20 | B | | | 25 | C | | |
| Moggill Road east | 13 | B | | | 8 | A | | |

| Road Network Element | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| | Eastbound | | Westbound | | Eastbound | | Westbound | |
| | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) |
| Overall Intersection | 18 | | B | | 14 | | B | |

**Table Notes:**

1) Data extracted from Paramics micro-simulation modelling using input 2 hour peak period demands from cordon matrix prepared using Northern Link Traffic Model. No peak spreading applied.

2) Average Speed = average speed on link during the middle hour of the peak two hour micro-simulation period.

3) Indicative level of service calculated based upon ratio between actual speed and free-flow speed.

4) Western Freeway assumed as 4 lanes (as existing) in 2014, with implementation of the following mitigation works at Moggill Road ramps : southbound – provision of auxiliary lane to allow 2 lane exit to Moggill Road ramp, northbound – extension auxiliary lane on Western Freeway to Waverley Road bridge.

6) Intersection level of service calculated based on average delay.

## ■ Table 4-11 Traffic Performance on Connecting Links to Northern Link Project (2026)

| Road Network Element | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| | Eastbound | | Westbound | | Eastbound | | Westbound | |
| | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) | Av Speed (2) | LoS (3) |
| Northern Link | | | | | | | | |
| Tunnel | 78 | A | 80 | A | 80 | A | 80 | A |
| Eastern Connection at Inner City Bypass | | | | | | | | |
| Inner City Bypass east of NL connections (i.e. at Landbridge) | 54 | C | 52 | C | 56 | B | 63 | B |
| Inner City Bypass west of NL connection (i.e. from Kelvin Grove Road entry & Hale Street) | 60 | B | - | - | 49 | C | - | - |
| Inner City Bypass west of NL connection (i.e. towards Ithaca Street exit & Hale Street) | - | - | 49 | C | - | - | 72 | B |
| Western Connection at Western Freeway(4) | | | | | | | | |
| Western Freeway east of tunnel portal (i.e. towards Mt Coot-tha Road) | 80 | A | 71 | B | 80 | A | 45 | C |
| Western Freeway at Northern Link diverge zone | 72 | B | - | - | 77 | B | - | - |
| Western Freeway at Northern Link merge zone | - | - | 80 | B | - | - | 72 | B |

**Table Notes:**

1) Data extracted from Paramics micro-simulation modelling using input 2 hour peak period demands from cordon matrix prepared using Northern Link Traffic Model. No peak spreading applied.

2) Average Speed = average speed on link during the middle hour of the peak two hour micro-simulation period.

3) Indicative level of service calculated based upon ratio between actual speed and free-flow speed.

4) Western Freeway assumed as 6 lanes in 2026 following implementation of SEQIPP transit lane project or similar.

## Table 4-12 Intersection Performance without and with the Project – 2014 and 2026

| Intersection | Peak | 2007 LOS (1) | 2014 | | | | 2026 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Without NL | | With Project | | Without NL | | With Project | |
| | | | Max DOS (2) | LOS (1) | Max DOS (2) | LOS (1) | Max DOS (2) | LOS (1) | Max DOS (2) | LOS (1) |
| **Coronation Drive** | | | | | | | | | | |
| Coronation Drive / Lang Parade (3) | AM | C | 1.01 | E | 1.06 | F | 1.05 | F | 1.10 | F |
| | PM | C | 1.09 | F | 0.89 | C | 0.88 | C | 0.89 | C |
| Coronation Drive / Boomerang Street | AM | B | 1.06 | F | 1.00 | C | 1.03 | E | 0.93 | D |
| | PM | D | 1.12 | F | 1.00 | D | 1.15 | F | 1.18 | F |
| **Milton Road** | | | | | | | | | | |
| Mt Coot-tha Road / Western Freeway roundabout (4) | AM | A | 1.12 | D | 0.84 | B | 2.48 | F | 0.89 | B |
| | PM | B | 1.35 | F | 0.71 | A | 2.86 | F | 0.92 | B |
| Frederick Street / Milton Road / Miskin Street | AM | F | 0.77 | C | 0.80 | A | 0.84 | D | 0.86 | B |
| | PM | E | 0.90 | A | 0.91 | B | 1.05 | C | 0.95 | B |
| Milton Road / Croydon Street / Morley Street | AM | C | 0.98 | E | 0.92 | D | 0.98 | E | 0.89 | D |
| | PM | D | 1.07 | F | 1.02 | E | 1.04 | F | 1.00 | E |
| Milton Road / Park Road / Baroona Street | AM | F | 1.07 | F | 1.07 | F | 1.11 | F | 1.09 | F |
| | PM | D | 0.96 | D | 0.94 | D | 1.02 | F | 0.97 | D |
| **Moggill Road** | | | | | | | | | | |
| Moggill Road / Western Freeway on ramp (5) | AM | A | 0.70 | A | 0.88 | C | 0.71 | A | 1.00 | C |
| | PM | C | 0.59 | B | 1.00 | B | 0.60 | B | 1.00 | C |
| Moggill Road / Western Freeway off ramp (5) | AM | C | 0.82 | C | 1.00 | C | 0.80 | B | 1.00 | C |
| | PM | C | 0.88 | C | 0.95 | C | 0.93 | C | 1.00 | C |
| Moggill Road / Jephson Street / High Street / Burns Road, Toowong | AM | C | 1.01 | F | 1.00 | D | 1.05 | F | 1.00 | D |
| | PM | C | 1.00 | D | 1.00 | D | 1.00 | D | 1.00 | D |
| **High Street** | | | | | | | | | | |
| High Street / Benson Street (Coronation Drive) | AM | C | 0.85 | C | 0.78 | C | 0.92 | C | 0.78 | C |
| | PM | D | 0.86 | C | 0.84 | C | 0.93 | D | 0.80 | C |
| **Jephson Street** | | | | | | | | | | |
| Jephson Street / Croydon Street | AM | D | 2.62 | F | 1.39 | F | 2.22 | F | 1.61 | F |
| | PM | D | 1.43 | F | 1.23 | F | 1.61 | F | 1.34 | F |
| **Kelvin Grove Road** | | | | | | | | | | |
| Kelvin Grove Road / Blamey Street | AM | B | 1.00 | E | 0.82 | C | 1.00 | E | 0.86 | C |
| | PM | A | 0.70 | B | 0.58 | B | 0.70 | B | 0.66 | B |
| Kelvin Grove Road / Ithaca Street | AM | C | 0.83 | D | 0.78 | C | 0.98 | E | 0.85 | C |
| | PM | C | 1.00 | F | 0.70 | B | 0.71 | C | 0.65 | B |
| Kelvin Grove Road / Prospect Terrace | AM | B | 0.81 | C | 0.78 | C | 0.81 | C | 0.81 | C |
| | PM | C | 1.01 | F | 0.97 | D | 1.05 | F | 1.00 | E |
| Normanby 5 Ways | AM | D | 0.90 | D | 0.82 | D | 0.83 | D | 0.83 | D |
| | PM | D | 0.70 | C | 0.96 | E | 1.02 | F | 0.94 | E |
| **Countess Street** | | | | | | | | | | |
| Countess Street / Upper Roma | AM | C | 1.01 | C | 1.00 | C | 1.00 | D | 1.00 | D |

| Intersection | Peak | 2007 LOS (1) | 2014 | | | | 2026 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Without NL | | With Project | | Without NL | | With Project | |
| | | | Max DOS (2) | LOS (1) | Max DOS (2) | LOS (1) | Max DOS (2) | LOS (1) | Max DOS (2) | LOS (1) |
| | PM | F | 1.23 | F | 1.24 | F | 1.19 | F | 1.10 | F |
| **Spring Hill** | | | | | | | | | | |
| College Road / Gregory Terrace | AM | B | 0.70 | B | 0.67 | B | 0.77 | C | 0.75 | C |
| | PM | C | 0.67 | C | 0.66 | C | 0.69 | C | 0.71 | C |
| **Herston Road- Bowen Bridge Road- Lutwyche Road** | | | | | | | | | | |
| ICB exit ramp / Herston Road | AM | - | 0.59 | B | 0.76 | B | 0.68 | B | 0.89 | C |
| | PM | - | 0.68 | B | 0.80 | C | 0.66 | B | 0.70 | B |
| Herston Road roundabout | AM | - | 0.72 | B | 0.74 | C | 0.73 | B | 0.91 | C |
| | PM | - | 0.77 | B | 0.71 | B | 0.76 | B | 0.74 | B |
| Bowen Bridge Road / Herston Road | AM | - | 0.82 | D | 0.91 | D | 0.79 | D | 0.91 | D |
| | PM | - | 0.82 | D | 0.90 | D | 0.80 | D | 0.88 | D |
| Bowen Bridge Road / Butterfield Street | AM | - | 0.85 | C | 0.83 | C | 0.87 | C | 0.85 | C |
| | PM | - | 0.94 | C | 0.96 | C | 0.98 | D | 1.01 | D |
| Lutwyche Road / Northey Street / ICB-CLEM7 ramp | AM | - | 0.91 | D | 0.86 | D | 1.00 | E | 0.95 | D |
| | PM | - | 0.83 | D | 0.89 | D | 0.90 | D | 0.84 | D |
| Lutwyche Road / Gallway Street-Northern Busway access | AM | | 0.82 | B | 0.81 | B | 0.89 | C | 0.92 | C |
| | PM | | 0.72 | B | 0.78 | B | 0.81 | B | 0.85 | B |

**Table Notes:**

1) Level of Service (LoS)

2) Degree of Saturation (DOS X)

3) Analysis for scenario with Northern Link incorporates re-allocation of an inbound lane on Coronation Drive as a bus lane.

4) Sharp decline in LoS and increase in DOS for scenario without Northern Link is due to increased conflict between right turn from Mt Coot-tha Road and increased eastbound demand from Western Freeway. Significant relief occurs with Northern Link project.

5) Double cycling of the signals using a 140 to 150 second cycle time has been applied in the SIDRA analysis.

### 4.1.5 Effects on Local Roads

The effect of the Project on traffic volumes on local roads has been assessed and compared to both the scenario without Northern Link, and to the EIS Reference Project.

Forecast effects on local roads are shown in **Table 4-13**. **Table 4-14** reports the modelled changes in traffic volume across screenlines located in the inner west suburbs.

The Project would provide sound levels of traffic relief across the surface network although the level of overall reduction in traffic on the surface network would not be as great as it would be for the EIS Reference Project. The relative comparison of effects on local roads between the EIS Reference Project and Project is tabulated in **Table 4-15** and **Table 4-16.**

Examples of the forecast effect of the Project in 2026 compared to the scenario without the Project include:

- On the Milton Road-Coronation Drive radial road corridors used by bus routes, and other roads used by east-west traffic, an 11% to 9% reduction by 2026 (26,000 vpd) in the network across the Toowong and

Milton screenlines[6] respectively is forecast. This includes traffic relief of about 14% on Coronation Drive and 6% on Milton Road.

- The Toowong activity centre would benefit from traffic reductions including a forecast decrease by 23% at High Street to 28,300 vehicles per day in 2026, which would be lower than existing traffic levels.
- Traffic on Moggill Road through Toowong would reduce by 18% to 40,800 vehicles per day, although there is a small increase at Indooroopilly (4%) as traffic from suburbs such as Indooroopilly and Taringa could access the Project via Moggill Road and the Western Freeway. This is also reflected in **Table 4-14** with an increase in traffic in 2026 over the Indooroopilly screenline slightly higher than that forecast for the EIS Reference Project.
- As the Project provides an orbital (or ring) route alternative within the network, a range of heavily trafficked regional ring roads in the broader Western Brisbane area are forecast to experience traffic reductions and improved operation. Examples at 2026 include Frederick Street (-9%) and Jubilee Terrace (-5%), which are components of MetRoad 5, and Miskin Street (-3%) and Sherwood Road (-19%) to the west of Jephson Street.
- Daily traffic reductions on many City Distributors such as Sylvan Road south of Croydon Street (-10%), Caxton Street (-11%) and Latrobe Terrace (-12%) would be experienced compared with the scenario without the project. Unlike the EIS Reference Project, traffic reduction would also be experienced on Jephson Street (-4%) and Burns Road (-4%).
- Croydon Street traffic volumes with the Project are forecast at 31,000 vpd, 4% higher than without the project (29,700 vpd) by 2026. By comparison, with the EIS Reference Project, a more substantial increase on Croydon Street was forecast, with volumes of 44,900 vpd forecast by 2026 with the local connection at Toowong. The forecast small increase in traffic on Croydon Street with the Project would occur due to a combination of factors - re-distribution of some local traffic from Moggill Road-Coronation Drive to Milton Road (via Croydon Street) due to reduced congestion on the surface network and the assumed implementation of an inbound bus/transit lane initiative on Coronation Drive with Northern Link.
- Reductions in daily traffic are forecast with the Project on many local streets throughout the inner west suburbs such as Eagle Terrace (-11%), Haig Road (-5%), Stuartholme Road (-10%), Rainworth Road (-38%), Sylvan Road east of Milton Road (-11%), Morley Street (-11%) and Birdwood Terrace (-12%). These forecast traffic reductions are sound, although in some cases are not as strong as that offered by the EIS Reference Project, as some additional trips were diverted from local streets with the local connections in place.

[6] A screenline is a notional boundary across roads within the inner west suburbs in the vicinity of the project across which traffic demands can be compared. Refer to Figure 5.3 in the Northern Link EIS for the location of screenlines and reporting points.

## Table 4-13 Volumes on Surface Roads within the Inner West Transport Study Area – With and Without the Project

| Hierarchy Reporting Point (1) | | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2014 | | | 2026 | | |
| | | | | | Without NL | With NL | % Difference | Without NL | With NL | % Difference |
| Regional Radial | | | | | | | | | | |
| | B | Moggill Road | East of Russell Terrace, Indooroopilly | 40,700 | 42,700 | 44,000 | +3% | 47,400 | 49,300 | +4% |
| | D | Moggill Road | East of Brisbane Boys College Entrance, Toowong | 38,500 | 46,600 | 38,400 | -18% | 49,500 | 40,800 | -18% |
| | F | High Street | West of Benson Street, Toowong | 32,400 | 34,200 | 26,400 | -23% | 36,800 | 28,300 | -23% |
| | X | Milton Road | West of Croydon Street, Toowong | 54,900 | 61,600 | 59,700 | -3% | 62,900 | 59,000 | -6% |
| | J | Milton Road | East of Croydon Street, Toowong | 52,900 | 64,800 | 61,900 | -4% | 67,700 | 63,400 | -6% |
| | O | Milton Road | East of Castlemaine Street, Milton | 51,500 | 68,200 | 63,500 | -7% | 70,800 | 68,100 | -4% |
| | K | Coronation Drive | West of Land Street, Auchenflower | 62,600 | 67,700 | 60,800 | -10% | 72,200 | 62,300 | -14% |
| | P | Coronation Drive | East of Cribb Street, Milton | 90,100 | 93,800 | 86,800 | -7% | 101,100 | 89,200 | -12% |
| **Regional Ring** | | | | | | | | | | |
| | C | Walter Taylor Bridge | Indooroopilly | 32,500 | 33,800 | 33,600 | -1% | 33,700 | 34,000 | +1% |
| | E | Miskin Street | North of Ascog Terrace, Toowong | 10,500 | 10,300 | 8,600 | -17% | 10,400 | 10,100 | -3% |
| | I | Frederick Street | South of Victoria Crescent, Toowong | 33,500 | 35,400 | 33,900 | -4% | 39,000 | 35,600 | -9% |
| | 19 | Hale Street | South of Caxton Street | 76,900 | 85,400 | 82,200 | -4% | 86,200 | 87,200 | 1% |
| | 30 | Jubilee Terrace | North of Coopers Camp Road | 27,700 | 30,000 | 28,800 | -4% | 31,900 | 30,200 | -5% |
| | 31 | Sherwood Road | West of Jephson Street | 5,400 | 5,900 | 4,000 | -32% | 7,000 | 5,700 | -19% |

| Hierarchy Reporting Point (1) | | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2014 | | | 2026 | | |
| | | | | | Without NL | With NL | % Difference | Without NL | With NL | % Difference |
| **City Distributor** | | | | | | | | | | |
| | G | Brisbane Street | North of Josling Street, Toowong | 37,100 | 42,600 | 41,700 | -2% | 45,700 | 44,300 | -3% |
| | S | Jephson Street | North of Sherwood Road | 13,000 | 27,200 | 24,000 | -12% | 29,600 | 24,100 | -19% |
| | 39 | Croydon Street | South of Milton Road | 12,000 | 30,400 | 32,500 | +7% | 29,700 | 31,000 | +4% |
| | W | Sylvan Road | South of Croydon Street, Toowong | 10,900 | 13,200 | 13,100 | -1% | 14,900 | 13,400 | -10% |
| | Q | Caxton Street | West of Hale Street, Paddington | 22,900 | 33,400 | 29,200 | -13% | 38,500 | 34,300 | -11% |
| | 32 | Latrobe Terrace | West of Enoggera Terrace | 14,200 | 17,700 | 16,400 | -7% | 21,300 | 18,700 | -12% |
| **Local Streets** | | | | | | | | | | |
| | L | Eagle Terrace | West of Roy Street, Auchenflower | 4,100 | 7,400 | 6,800 | -8% | 8,900 | 7,900 | -11% |
| | M | Haig Road | West of Barona Road, Milton | 6,500 | 14,000 | 9,900 | -29% | 17,100 | 16,300 | -5% |
| | N | Park Road Mid-block | North of Gordon Street, Milton | 12,100 | 12,900 | 12,900 | 0% | 17,200 | 15,300 | -11% |
| | 33 | Sir Samuel Griffith Drive | North of Birdwood Terrace | 5,300 | 10,400 | 6,800 | -35% | 13,300 | 9,800 | -26% |
| | 34 | Stuartholme Road | North of Birdwood Terrace | 3,600 | 3,800 | 4,200 | +11% | 5,100 | 4,600 | -10% |
| | 35 | Enoggera Terrace | North of Latrobe Terrace | 5,100 | 7,400 | 6,300 | -15% | 9,900 | 8,300 | -16% |
| | 4 | Burns Road | East of railway | 4,400 | 6,000 | 5,300 | -12% | 6,400 | 5,500 | -14% |
| | 28 | Rainworth Road | East of Rouen Road | 4,300 | 7,500 | 5,800 | -23% | 9,900 | 6,100 | -38% |
| | 36 | Morley Street | North of Milton Road | 3,900 | 7,700 | 4,700 | -39% | 6,200 | 5,500 | -11% |
| | 37 | Lang Parade | North of Coronation Drive | 6,800 | 8,300 | 8,500 | +2% | 10,400 | 10,000 | -4% |
| | 29 | Birdwood Tce | East of Gregory Street | 1,600 | 5,400 | 3,000 | -44% | 4,200 | 3,700 | -12% |
| | 38 | Heussler Terrace | West of Castlemaine Street | 8,000 | 14,400 | 10,500 | -27% | 18,300 | 15,900 | -13% |
| | H | Sylvan Road | East of Milton Road, Toowong | 8,400 | 5,200 | 5,100 | -2% | 6,600 | 5,900 | -11% |

**Table Note:** Source: Northern Link Traffic Model

(1) Refer to Figure 5.3 in the Northern Link EIS for the location of screenlines and reporting points.

## Table 4-14 Surface Traffic Differences within the Inner West Transport Study Area – With and Without the Project

| Screenline[1] | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2014 | | | 2026 | | |
| | | Without NL | Project | % Difference | Without NL | Project | % Difference |
| 1 – Indooroopilly | 162,400 | 178,300 | 202,800 | +14% | 196,900 | 231,600 | +18% |
| 2- St Lucia and University | 73,800 | 81,700 | 81,400 | 0% | 88,100 | 87,700 | 0% |
| 3 – Toowong | 174,200 | 211,000 | 190,000 | -10% | 230,000 | 203,600 | -11% |
| 4 - Milton | 205,500 | 245,800 | 224,900 | -9% | 266,400 | 241,300 | -9% |

**Table Notes**:

Source: Northern Link Traffic Model

1). A screenline is a notional boundary across roads within the inner west suburbs in the vicinity of the project across which traffic demands can be compared. Refer to Figure 5.3 in the Northern Link EIS for the location of screenlines and reporting points.

- **Table 4-15 Volumes on Surface Roads within the Inner West Transport Study Area - The Project compared with the EIS Reference Project**

| Hierarchy Reporting Point | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2014 | | | 2026 | | |
| | | | | EIS Project | Project | % Change | EIS Project | Project | % Change |
| Regional Radial | | | | | | | | | |
| B | Moggill Road | East of Russell Terrace, Indooroopilly | 40,700 | 40,500 | 44,000 | +9% | 45,300 | 49,300 | +9% |
| D | Moggill Road | East of Brisbane Boys College Entrance, Toowong | 38,500 | 40,500 | 38,400 | -5% | 44,000 | 40,800 | -7% |
| F | High Street | West of Benson Street, Toowong | 32,400 | 27,200 | 26,400 | -3% | 29,000 | 28,300 | -2% |
| X | Milton Road | West of Croydon Street, Toowong | 54,900 | 58,800 | 59,700 | +2% | 61,700 | 59,000 | -4% |
| J | Milton Road | East of Croydon Street, Toowong | 52,900 | 57,400 | 61,900 | +8% | 64,000 | 63,400 | -1% |
| O | Milton Road | East of Castlemaine Street, Milton | 51,500 | 58,900 | 63,500 | +8% | 65,700 | 68,100 | +4% |
| K | Coronation Drive | West of Land Street, Auchenflower | 62,600 | 58,700 | 60,800 | +4% | 60,200 | 62,300 | +3% |
| P | Coronation Drive | East of Cribb Street, Milton | 90,100 | 83,900 | 86,800 | +3% | 86,700 | 89,200 | +3% |
| **Regional Ring** | | | | | | | | | |
| C | Walter Taylor Bridge | Indooroopilly | 32,500 | 33,600 | 33,600 | 0% | 33,700 | 34,000 | +1% |
| E | Miskin Street | North of Ascog Terrace, Toowong | 10,500 | 8,200 | 8,600 | +5% | 9,300 | 10,100 | +9% |
| I | Frederick Street | South of Victoria Crescent, Toowong | 33,500 | 33,700 | 33,900 | +1% | 33,400 | 35,600 | +7% |
| 19 | Hale Street | South of Caxton Street | 76,900 | 82,700 | 82,200 | -1% | 88,000 | 87,200 | -1% |
| 30 | Jubilee Terrace | North of Coopers Camp Road | 27,700 | 26,500 | 28,800 | +9% | 27,900 | 30,200 | +8% |
| 31 | Sherwood Road | West of Jephson Street | 5,400 | 4,400 | 4,000 | -9% | 5,900 | 5,700 | -3% |

| Hierarchy Reporting Point | Road | Location | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2014 | | | 2026 | | |
| | | | | EIS Project | Project | % Change | EIS Project | Project | % Change |
| **City Distributor** | | | | | | | | | |
| G | Brisbane Street | North of Josling Street, Toowong | 37,100 | 42,000 | 41,700 | -1% | 45,100 | 44,300 | -2% |
| W | Sylvan Road | South of Croydon Street, Toowong | 10,900 | 13,200 | 13,100 | -1% | 12,100 | 13,400 | +11% |
| Q | Caxton Street | West of Hale Street, Paddington | 22,900 | 29,200 | 29,200 | 0% | 31,400 | 34,300 | +9% |
| 32 | Latrobe Terrace | West of Enoggera Terrace | 14,200 | 16,400 | 16,400 | 0% | 17,900 | 18,700 | +4% |
| **Local Streets** | | | | | | | | | |
| L | Eagle Terrace | West of Roy Street, Auchenflower | 4,100 | 6,000 | 6,800 | +13% | 6,800 | 7,900 | +16% |
| M | Haig Road | West of Barona Road, Milton | 6,500 | 9,300 | 9,900 | +6% | 9,700 | 16,300 | +68% |
| N | Park Road Mid-block | North of Gordon Street, Milton | 12,100 | 12,900 | 12,900 | 0% | 13,800 | 15,300 | +11% |
| 33 | Sir Samuel Griffith Drive | North of Birdwood Terrace | 5,300 | 4,600 | 6,800 | +48% | 6,600 | 9,800 | +48% |
| 34 | Stuartholme Road | North of Birdwood Terrace | 3,600 | 3,500 | 4,200 | +20% | 4,100 | 4,600 | +12% |
| 35 | Enoggera Terrace | North of Latrobe Terrace | 5,100 | 5,700 | 6,300 | +11% | 7,100 | 8,300 | +17% |
| 28 | Rainworth Road | East of Rouen Road | 4,300 | 3,800 | 5,800 | +53% | 5,800 | 6,100 | +5% |
| 36 | Morley Street | North of Milton Road | 3,900 | 3,800 | 4,700 | +24% | 4,600 | 5,500 | +20% |
| 37 | Lang Parade | North of Coronation Drive | 6,800 | 8,100 | 8,500 | +5% | 9,800 | 10,000 | +2% |
| 29 | Birdwood Tce | East of Gregory Street | 1,600 | 2,400 | 3,000 | +25% | 2,400 | 3,700 | +54% |
| 38 | Heussler Terrace | West of Castlemaine Street | 8,000 | 9,500 | 10,500 | +11% | 10,200 | 15,900 | +56% |
| H | Sylvan Road | East of Milton Road, Toowong | 8,400 | 4,400 | 5,100 | +16% | 4,000 | 5,900 | +48% |

**Table Note:** Source: Northern Link Traffic Model

## Table 4-16 Surface Traffic Changes within the Inner West Transport Study Area – The Project compared with the EIS Reference Project

| Screenline[1] | 2007 | Average Weekday Traffic | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2014 | | | 2026 | | |
| | | EIS Reference Project | Project | % Change | EIS Reference Project | Project | % Change |
| 1 – Indooroopilly | 162,400 | 199,500 | 202,800 | +2% | 228,200 | 231,600 | +1% |
| 2- St Lucia and University | 73,800 | 81,300 | 81,400 | 0% | 87,800 | 87,700 | 0% |
| 3 – Toowong | 174,200 | 176,000 | 190,000 | +8% | 189,200 | 203,600 | +8% |
| 4 - Milton | 205,500 | 212,500 | 224,900 | +6% | 227,700 | 241,300 | +6% |

**Table Notes**:

Source: Northern Link Traffic Model

1). A screenline is a notional boundary across roads within the inner west suburbs in the vicinity of the project across which traffic demands can be compared

### 4.1.6 Metropolitan Area Network Performance

The forecast effect of the Northern Link Project on the overall Metropolitan Area network performance is summarised in **Table 4-17** and illustrated in **Figure 4-5** , **Figure 4-6**, **Figure 4-7**, and **Figure 4-8.** A comparison between the EIS Reference Project and the Project is shown in **Table 4-18**.

The metropolitan area network performance of the Project is similar to the EIS Reference Project. Lower order roads would gain a benefit from the implementation of Northern Link with an overall decrease in VKT, or amount of travel, on these roads. The increase in VKT on motorways shows the redistribution of traffic from these lower order roads to Northern Link. There would be a very slight increase in overall vehicle kilometres travelled on the network (i.e. 0.1%) in 2026.

A sound reduction in the overall vehicle hours of travel in the network is forecast with the Project for all vehicles and commercial vehicles, which would yield benefits to industry by reducing operating cost through increased travel speeds on the network and improved amenity within residential areas via reduced congestion on the surface network.

**Table 4-17 Network Performance by Road Type without and with the Northern Link Project**

| Road Type | Without NL[5] | | | Project[5] | | | Difference | | % Difference | |
|---|---|---|---|---|---|---|---|---|---|---|
| | VHT[1] | VKT[2][4] | Speed Km/h | VHT[1] | VKT[2][4] | Speed Km/h | VHT[1] | VKT[2][4] | VHT[1] | VKT[2][4] |
| 2014 | | | | | | | | | | |
| Motorway | 294,900 | 24,526,500 | | 296,600 [3] | 24,717,600[3] | | +1,700 | +191,100 | +0.6% | +0.8% |
| Arterial | 446,200 | 20,531,400 | | 440,700 | 20,444,700 | | -5,500 | -86,700 | -1.2% | -0.4% |
| Suburban | 165,900 | 8,099,500 | | 165,100 | 8,073,500 | | -800 | -26,000 | -0.5% | -0.3% |
| District | 104,800 | 3,530,800 | | 103,000 | 3,503,100 | | -1,800 | -27,700 | -1.7% | -0.8% |
| Local | 53,400 | 1,324,000 | | 53,300 | 1,313,800 | | -100 | -10,200 | -0.2% | -0.8% |
| Total | **1,065,300** | **58,012,200** | **54.5** | **1,058,600** | **58,052,600** | **54.8** | **-6,700** | **40,400** | **-0.6%** | **+0.1%** |
| **2026** | | | | | | | | | | |
| Motorway | 408,400 | 32,606,900 | | 409,200 [3] | 32,888,000[3] | | +800 | +281,100 | +0.2% | +0.9% |
| Arterial | 520,200 | 23,562,000 | | 508,700 | 23,432,800 | | -11,500 | -129,200 | -2.2% | -0.5% |
| Suburban | 200,400 | 9,597,000 | | 199,800 | 9,561,800 | | -600 | -35,200 | -0.3% | -0.4% |
| District | 140,000 | 4,147,300 | | 137,200 | 4,119,400 | | -2,800 | -27,900 | -2.0% | -0.7% |
| Local | 67,500 | 1,478,100 | | 68,300 | 1,474,900 | | 800 | -3,200 | 1.2% | -0.2% |
| Total | **1,336,300** | **71,391,400** | **53.4** | **1,323,100** | **71,477,000** | **54.0** | **-13,200** | **+85,600** | **-1.0%** | **+0.1%** |

**Table Notes:**

1) VHT - Vehicle Hours Travelled on Average Weekday

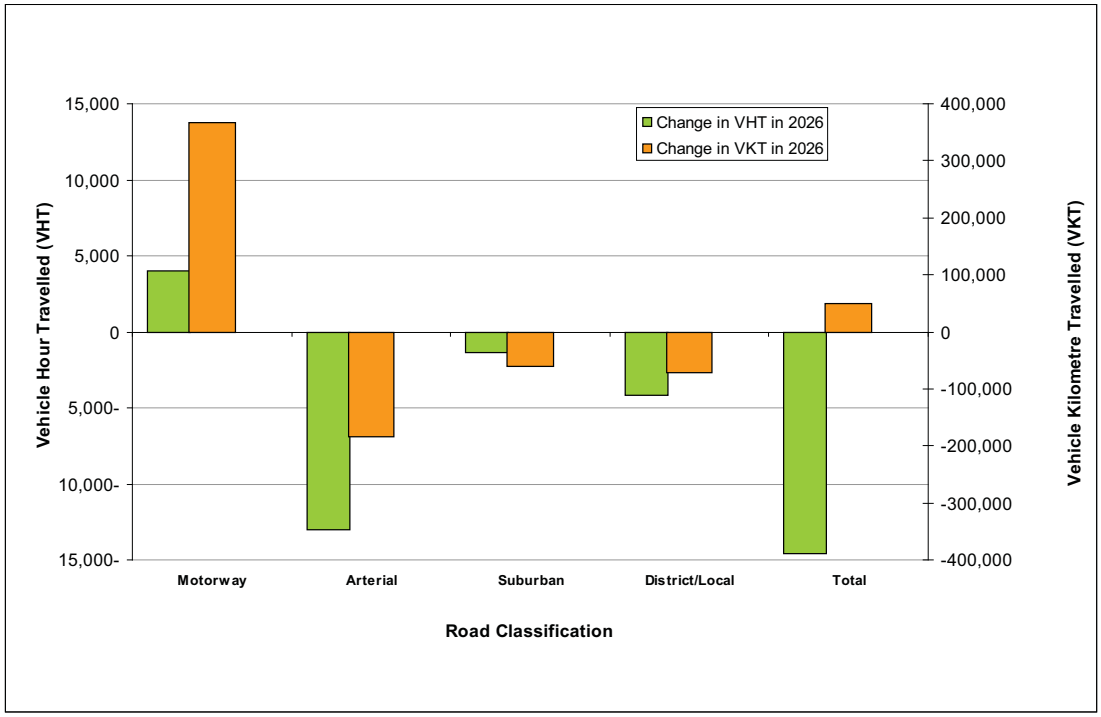
2) VKT - Vehicle Kilometres Travelled on Average Weekday

3) Includes NL Tunnel VHT and VKT

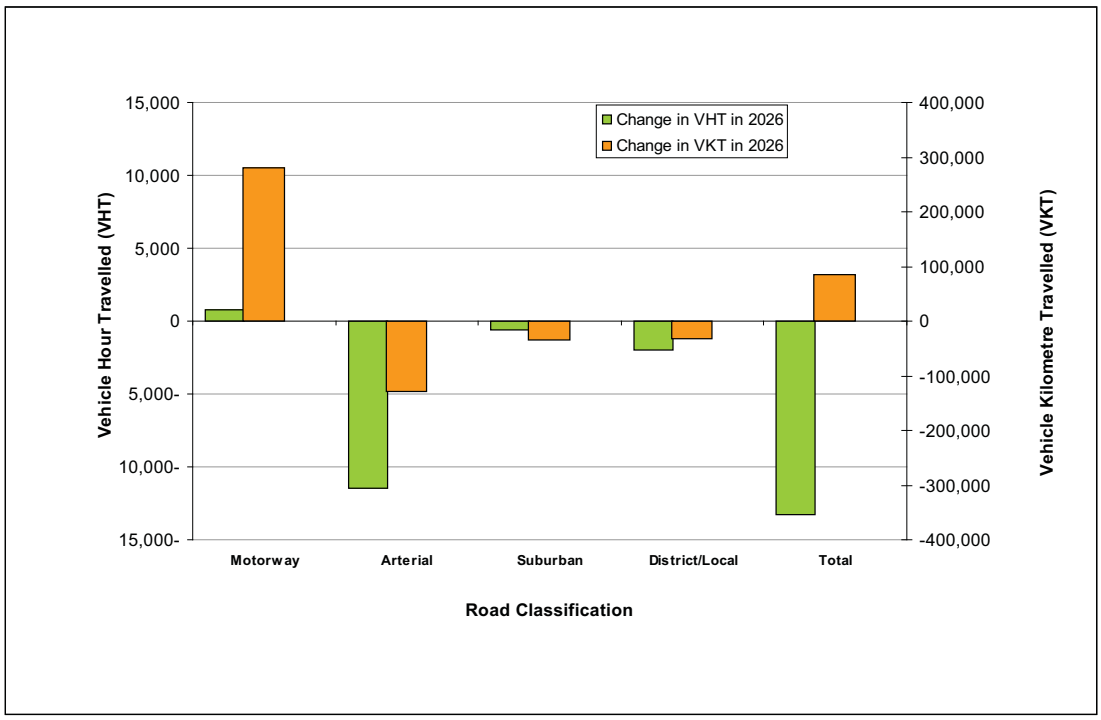
4) Excludes travel on traffic zone centroid connectors within traffic model.

5) Modelling incorporates updated base future network projects.

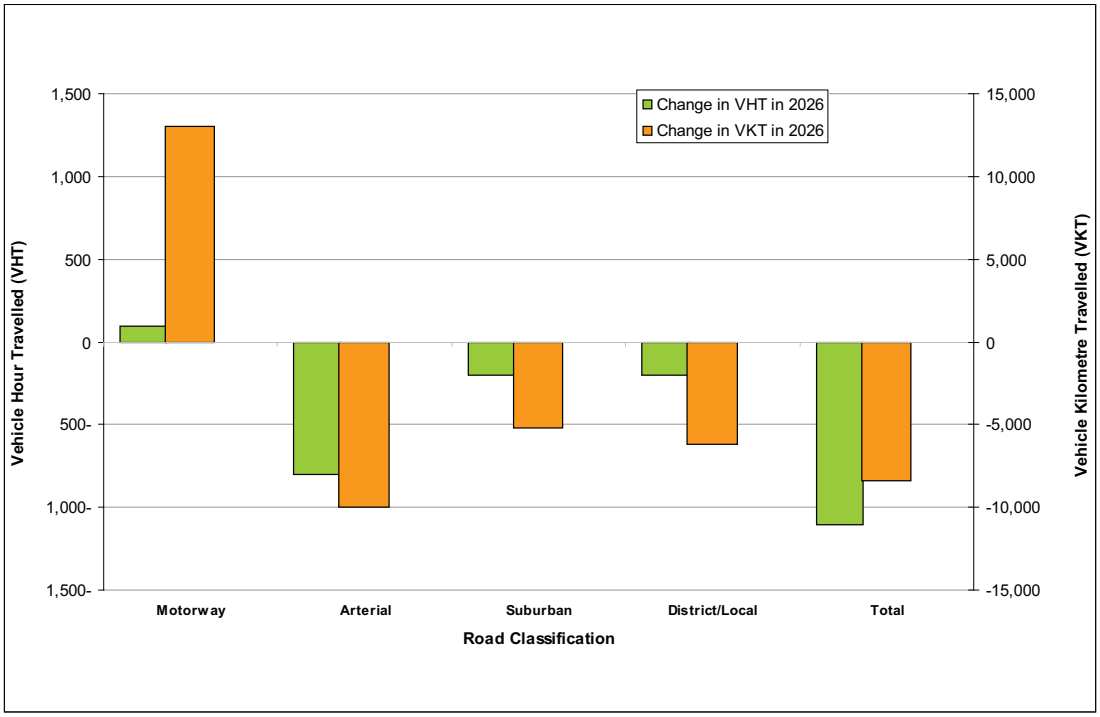
- **Figure 4-5 Changes in Overall Vehicle Kilometres and Vehicle Hours of Travel with the EIS Reference Design (TR_2026_256 vs TR_2026_255)**



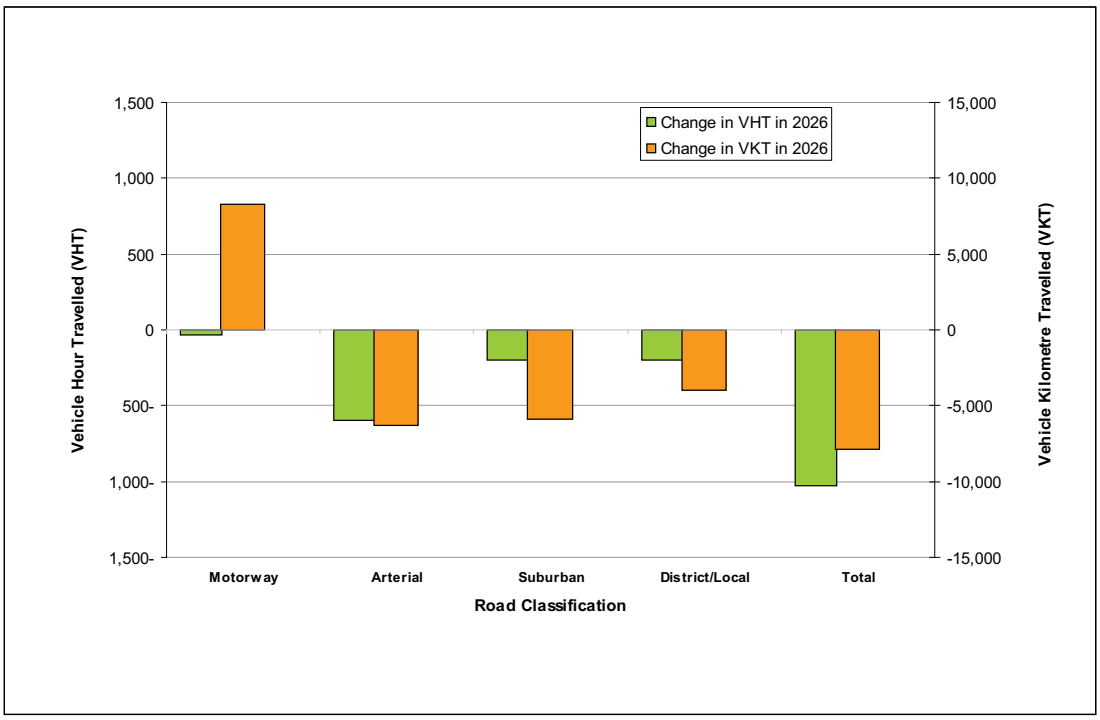

- **Figure 4-6Changes in Overall Vehicle Kilometres and Vehicle Hours of Travel with the Project (TR_2026_257 vs TR_2026_255)**



- **Figure 4-7 Changes in Commercial Vehicle Kilometres and Commercial Vehicle Hours of Travel with the EIS Reference Design (TR_2026_256 vs TR_2026_255)**




- **Figure 4-8 Changes in Commercial Vehicle Kilometres and Commercial Vehicle Hours of Travel with the Project (TR_2026_257 vs TR_2026_255)**



- **Table 4-18 Network Performance by Road Type - Comparison of the Northern Link Traffic Project with the EIS Reference Project**

| Road Type | EIS Reference Project[5] | | | Project[5] | | | Difference | | % Difference | |
|---|---|---|---|---|---|---|---|---|---|---|
| | VHT[1] | VKT[2][4] | Speed Km/h | VHT[1] | VKT[2][4] | Speed Km/h | VHT[1] | VKT[2][4] | VHT[1] | VKT[2][4] |
| 2014 | | | | | | | | | | |
| Motorway | 297,700 | 24,803,700 | | 296,600 | 24,717,600 | | -1,100 | -86,100 | -0.4% | -0.3% |
| Arterial | 439,600 | 20,409,500 | | 440,700 | 20,444,700 | | +1,100 | +35,200 | +0.3% | +0.2% |
| Suburban | 164,400 | 8,056,700 | | 165,100 | 8,073,500 | | +700 | +16,800 | +0.4% | +0.2% |
| District | 105,400 | 3,495,500 | | 103,000 | 3,503,100 | | -2,400 | +7,600 | -2.3% | +0.2% |
| Local | 49,900 | 1,304,100 | | 53,300 | 1,313,800 | | +3,400 | +9,700 | +6.8% | +0.7% |
| Total | **1,057,000** | **58,069,500** | **54.9** | **1,058,600** | **58,052,600** | **54.8** | **+1,600** | **-16,900** | **+0.2%** | **0.0%** |
| **2026** | | | | | | | | | | |
| Motorway | 412,400 | 32,973,000 | | 409,200 | 32,888,000 | | -3,200 | -85,000 | -0.8% | -0.3% |
| Arterial | 507,200 | 23,377,000 | | 508,700 | 23,432,800 | | +1,500 | +55,800 | +0.3% | +0.2% |
| Suburban | 199,000 | 9,537,400 | | 199,800 | 9,561,800 | | +800 | +24,400 | +0.4% | +0.3% |
| District | 136,400 | 4,094,500 | | 137,200 | 4,119,400 | | +800 | +24,900 | +0.6% | +0.6% |
| Local | 66,900 | 1,459,000 | | 68,300 | 1,474,900 | | +1,400 | +15,900 | +2.1% | +1.1% |
| Total | **1,321,858** | **71,440,953** | **54.0** | **1,323,100** | **71,476,995** | **54.0** | **+1,242** | **+36,041** | **0.1%** | **0.1%** |

**Table Notes:**

1) VHT - Vehicle Hours Travelled on Average Weekday

2) VKT - Vehicle Kilometres Travelled on Average Weekday

3) Includes NL Tunnel VHT and VKT

4) Excludes travel on traffic zone centroid connectors within traffic model.

5) Modelling incorporates updated base future network projects.

### 4.1.7 Travel Time Benefits

An assessment of the effect of the Project on travel times has been undertaken by comparing estimates of peak period travel times without the project to travel times, both on surface road routes and via Northern Link itself, once the project is operational.

Estimated travel times for key routes during peak periods without and with Northern Link have been extracted from the strategic model. **Table 4-19** provides a summary of forecast travel times for regional and cross city routes. **Table 4-20** summaries forecast travel times for central city and inner west trips. **Table 4-21** and **Table** 4-22 provide a comparison of travel time routes for the Northern Link Project and the EIS Reference Project. These routes were shown in the EIS (Figure 5-47) and cover key travel movements within the study area and the greater metropolitan area such as:

- regional cross-city trips to the ATC/Airport from the Western Corridor (Route D)and cross-city travel (Route A: Centenary Bridge to ICB Land Bridge) that would could directly use the Project; and
- examples of cross-city or other trips types that would benefit from reduced congestion on surface routes in the inner west (e.g. Route E: Indooroopilly to Chermside; Route B: Chapel Hill to Spring Hill; Route C; Toowong to Newmarket; and Route F; Toowong to Airport).

Significant travel time savings would be available to those using the Northern Link Project. Typical time savings are over 20% (over 15 minutes) for trips between the Western Corridor and Brisbane Airport during both the morning and evening peak periods in 2026. Time savings of 20 minutes (almost 70%) would be experienced for trips between the Centenary Bridge and the Inner City Bypass Land Bridge during the morning peak period in 2026 and over 13 minutes would be saved during the evening peak period for the return journey. These are similar to the EIS Reference Project time savings. **Figure 4-9** illustrates the change in morning peak period travel times from Indooroopilly that would be experienced in 2026 for Northern Link users compared to the situation without the project. As with the EIS Reference Project, the travel time benefits provided by the Project for cross-city travel extend over a wide reach, and improve the convenience of travel between the Western Corridor and western suburbs of Brisbane, and the regional road network to the north of Brisbane and the Australia TradeCoast.

As the Project does not have local connections at Toowong and Kelvin Grove the significant time savings offered by the EIS Reference Project for trips between Toowong and other destinations such as the Airport and Central Brisbane via Northern Link are not available. Travel time savings provided by the Project in 2026 are generally offered however due to reduced congestion on the surface network in the inner west, with time savings of around 5 minutes on the surface network via both Milton Road and Coronation Drive. These surface route travel time savings are slightly less than for the EIS Reference Project due to the different level of surface traffic relief.

- **Table 4-19 Effects of Northern Link Project on Travel Times and Speeds for Key Routes – Regional and ATC/Airport Travel**

| Route | Direction | Without NL | | Project | | | | time difference (minutes) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | On Surface | | Via NL | | On Surface | | Via NL | |
| | | (min) | (km/h) | (min) | (km/h) | (min) | (km/h) | (min) | (%) | (min) | (%) |
| **AM Peak Hour** | | | | | | | | | | | |
| **2014** | | | | | | | | | | | |
| D - Western Corridor to Airport | E/B – N/B | 57 | 69 | 56 | 70 | 45 | 76 | -0.9 | -1.6% | -11.5 | -20.2% |
| E - Indooroopilly to Chermside | E/B – N/B | 36 | 33 | 34 | 34 | X | X | -1.3 | -3.8% | X | X |
| F - Toowong to Airport - Milton Road | E/B – N/B | 25 | 44 | 27 | 42 | X | X | +1.1 | +4.2% | X | X |
| F - Toowong to Airport - Coronation Drive | E/B – N/B | 29 | 38 | 29 | 39 | X | X | -0.3 | -1.0% | X | X |
| **2026** | | | | | | | | | | | |
| D - Western Corridor to Airport | E/B – N/B | 67 | 58 | 66 | 59 | 52 | 66 | -1.5 | -2.3% | -15.1 | -22.4% |
| E - Indooroopilly to Chermside | E/B – N/B | 39 | 30 | 35 | 34 | X | X | -4.2 | -12.1% | X | X |
| F - Toowong to Airport - Milton Road | E/B – N/B | 42 | 27 | 36 | 31 | X | X | -6.0 | -16.8% | X | X |
| F - Toowong to Airport - Coronation Drive | E/B – N/B | 39 | 29 | 37 | 30 | X | X | -1.6 | -4.3% | X | X |
| **PM Peak Hour** | | | | | | | | | | | |
| **2014** | | | | | | | | | | | |
| D - Western Corridor to Airport | W/B – S/B | 57 | 68 | 56 | 69 | 46 | 76 | -0.6 | -1.1% | -11.1 | -19.6% |
| E - Indooroopilly to Chermside | W/B – S/B | 40 | 29 | 36 | 32 | X | X | -4.0 | -11.1% | X | X |
| F - Toowong to Airport - Milton Road | W/B – S/B | 29 | 41 | 30 | 41 | X | X | +0.3 | +1.0% | X | X |
| F - Toowong to Airport - Coronation Drive | W/B – S/B | 34 | 35 | 33 | 36 | X | X | -1.1 | -3.3% | X | X |
| **2026** | | | | | | | | | | | |
| D - Western Corridor to Airport | W/B – S/B | 65 | 60 | 64 | 61 | 47 | 73 | -1.4 | -2.2% | -17.6 | -27.1% |
| E - Indooroopilly to Chermside | W/B – S/B | 43 | 27 | 38 | 31 | X | X | -4.5 | -11.8% | X | X |
| F - Toowong to Airport - Milton Road | W/B – S/B | 37 | 33 | 32 | 37 | X | X | -4.2 | -13.0% | X | X |
| F - Toowong to Airport - Coronation Drive | W/B – S/B | 39 | 31 | 36 | 33 | X | X | -2.4 | -6.6% | X | X |

**Table Note**:

Source: Northern Link Traffic Model

- **Table 4-20 Effects of Northern Link Project on Travel Times and Speeds for Key Routes – Central City and Inner West Travel**

| Route | Direction | Without NL | | Project | | | | time difference (minutes) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | via Milton Road | | via Milton Road | | via NL | | On Surface | | Via NL | |
| | | (min) | (km/h) | (min) | (km/h) | (min) | (km/h) | (min) | (%) | (min) | (%) |
| **AM Peak Hour** | | | | | | | | | | | |
| **2014** | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | E/B – N/B | 20 | 37 | 21 | 36 | 11 | 63 | +0.3 | +1% | -8.9 | -44% |
| B - Chapel Hill to Spring Hill | E/B – N/B | 18 | 29 | 17 | 31 | X | X | -1.3 | -8% | X | X |
| C - Toowong to Newmarket | E/B – N/B | 13 | 31 | 14 | 29 | X | X | +1.0 | +7% | X | X |
| **2026** | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | E/B – N/B | 30 | 25 | 22 | 35 | 10 | 74 | -8.2 | -38% | -20.1 | -68% |
| B - Chapel Hill to Spring Hill | E/B – N/B | 27 | 19 | 19 | 27 | X | X | -7.8 | -41% | X | X |
| C - Toowong to Newmarket | E/B – N/B | 22 | 19 | 16 | 25 | X | X | -5.9 | -36% | X | X |
| **PM Peak Hour** | | | | | | | | | | | |
| **2014** | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | W/B – S/B | 20 | 37 | 21 | 35 | 12 | 59 | +1.5 | +7% | -7.8 | -39% |
| B - Chapel Hill to Spring Hill | W/B – S/B | 20 | 28 | 20 | 27 | X | X | +0.7 | +3% | X | X |
| C - Toowong to Newmarket | W/B – S/B | 17 | 26 | 16 | 27 | X | X | -0.6 | -4% | X | X |
| **2026** | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | W/B – S/B | 24 | 31 | 20 | 37 | 10 | 69 | -3.7 | -18% | -13.6 | -57% |
| B - Chapel Hill to Spring Hill | W/B – S/B | 25 | 22 | 21 | 26 | X | X | -3.8 | -18% | X | X |
| C - Toowong to Newmarket | W/B – S/B | 22 | 20 | 17 | 26 | X | X | -5.1 | -31% | X | X |

**Table Note**:

Source: Northern Link Traffic Model

- **Table 4-21 Comparison of Northern Link Project and the EIS Reference Project on Travel Times and Speeds for Key Routes – Regional and ATC/Airport Travel**

| Route | Direction | Project | | | | EIS Reference Project | | | | time difference (minutes) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | On Surface | | Via NL | | On Surface | | Via NL | | On Surface | | Via NL | |
| | | (min) | (km/h) | (min) | (km/h) | (min) | (km/h) | (min) | (km/h) | (min) | (%) | (min) | (%) |
| **AM Peak Hour** | | | | | | | | | | | | | |
| **2014** | | | | | | | | | | | | | |
| D - Western Corridor to Airport | E/B – N/B | 56 | 70 | 45 | 76 | 56 | 70 | 46 | 76 | 0.0 | 0.0% | -0.4 | -0.9% |
| E - Indooroopilly to Chermside | E/B – N/B | 34 | 34 | X | X | 33 | 35 | 20 | 53 | +1.0 | +3.0% | X | X |
| F - Toowong to Airport - Milton Road | E/B – N/B | 27 | 42 | X | X | 25 | 45 | 14 | 80 | +1.3 | +5.2% | X | X |
| F - Toowong to Airport - Coronation Drive | E/B – N/B | 29 | 39 | X | X | 27 | 41 | 14 | 80 | +1.7 | +6.3% | X | X |
| **2026** | | | | | | | | | | | | | |
| D - Western Corridor to Airport | E/B – N/B | 66 | 59 | 52 | 66 | 66 | 59 | 52 | 67 | +0.2 | +0.3% | +0.3 | +0.6% |
| E - Indooroopilly to Chermside | E/B – N/B | 35 | 34 | X | X | 35 | 34 | 20 | 52 | +0.1 | +0.3% | X | X |
| F - Toowong to Airport - Milton Road | E/B – N/B | 36 | 31 | X | X | 33 | 34 | 19 | 59 | +2.9 | +8.8% | X | X |
| F - Toowong to Airport - Coronation Drive | E/B – N/B | 37 | 30 | X | X | 35 | 32 | 19 | 59 | +1.6 | +4.5% | X | X |
| **PM Peak Hour** | | | | | | | | | | | | | |
| **2014** | | | | | | | | | | | | | |
| D - Western Corridor to Airport | W/B – S/B | 56 | 69 | 46 | 76 | 56 | 70 | 45 | 77 | +0.4 | +0.7% | +0.6 | +1.3% |
| E - Indooroopilly to Chermside | W/B – S/B | 36 | 32 | X | X | 35 | 33 | 20 | 51 | +0.9 | +2.6% | X | X |
| F - Toowong to Airport - Milton Road | W/B – S/B | 30 | 41 | X | X | 29 | 42 | 14 | 80 | +1.1 | +3.9% | X | X |
| F - Toowong to Airport - Coronation Drive | W/B – S/B | 33 | 36 | X | X | 32 | 38 | 14 | 80 | +1.4 | +4.4% | X | X |
| **2026** | | | | | | | | | | | | | |
| D - Western Corridor to Airport | W/B – S/B | 64 | 61 | 47 | 73 | 63 | 61 | 48 | 72 | +0.3 | +0.5% | -1.0 | -2.1% |
| E - Indooroopilly to Chermside | W/B – S/B | 38 | 31 | X | X | 36 | 32 | 20 | 51 | +2.2 | +6.1% | X | X |
| F - Toowong to Airport - Milton Road | W/B – S/B | 32 | 37 | X | X | 32 | 38 | 14 | 80 | +0.3 | +0.9% | X | X |
| F - Toowong to Airport - Coronation Drive | W/B – S/B | 36 | 33 | X | X | 35 | 35 | 14 | 80 | +1.5 | +4.3% | X | X |

**Table Note**: Source: Northern Link Traffic Model

- **Table 4-22 Comparison of Northern Link Project and the EIS Reference Project on Travel Times and Speeds for Key Routes – Central City and Inner West Travel**

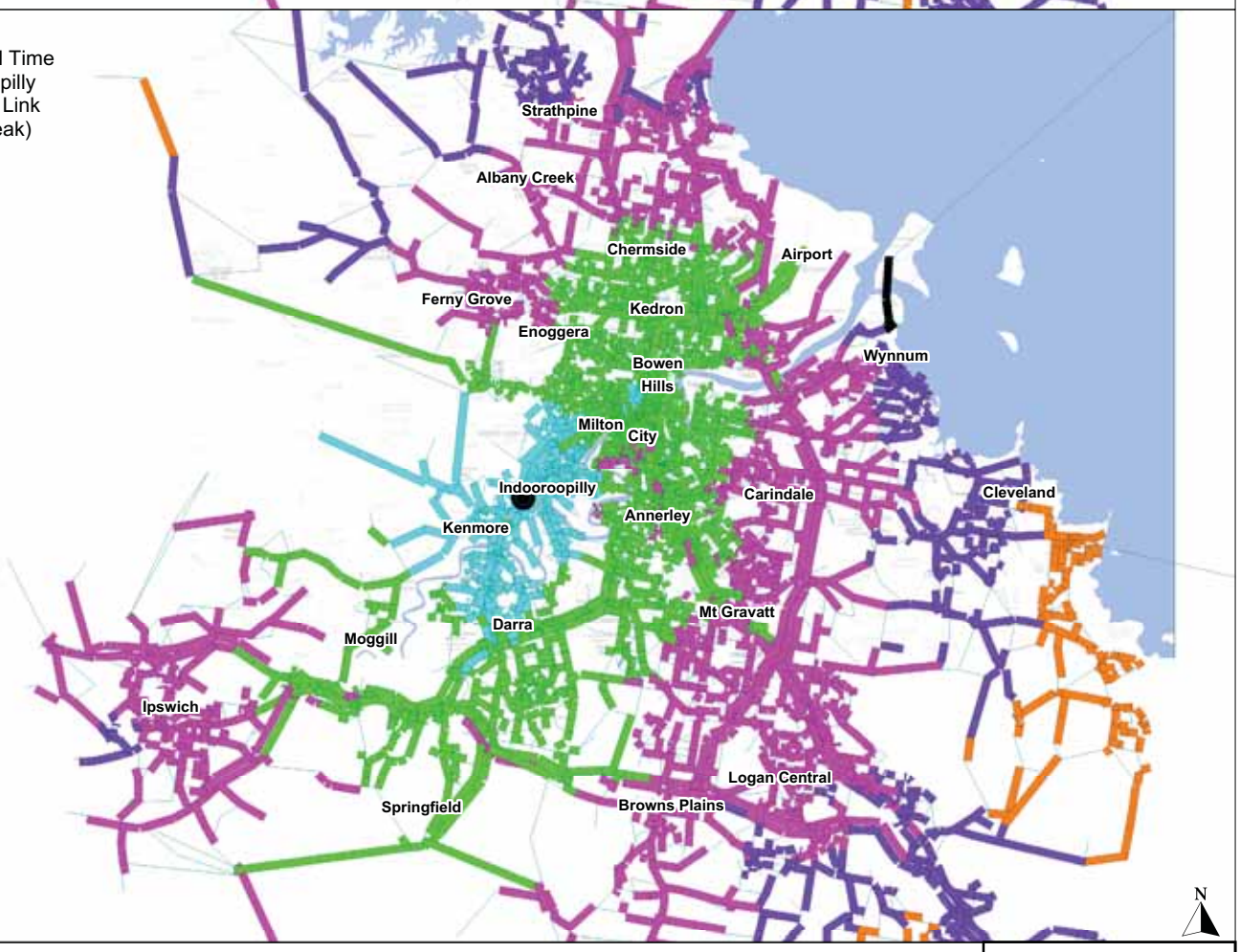
| Route | Direction | Project | | | | EIS Reference Project | | | | Time difference (minutes) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | via Milton Road | | via Northern Link | | Milton Road | | via Northern Link | | Milton Road | | via Northern Link | |
| | | (min) | (km/h) | (min) | (km/h) | (min) | (km/h) | (min) | (km/h) | min | % | min | % |
| **AM Peak Hour** | | | | | | | | | | | | | |
| **2014** | | | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | E/B – N/B | 21 | 36 | 11 | 63 | 20 | 38 | 12 | 61 | +1.0 | 5% | -0.3 | -3% |
| B - Chapel Hill to Spring Hill | E/B – N/B | 17 | 31 | X | X | 16 | 34 | 10 | 55 | +1.4 | 9% | X | X |
| C - Toowong to Newmarket | E/B – N/B | 14 | 29 | X | X | 13 | 32 | 9 | 50 | +1.1 | 9% | X | X |
| **2026** | | | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | E/B – N/B | 22 | 35 | 10 | 74 | 18 | 41 | 9 | 79 | +3.3 | +18% | +0.5 | +5% |
| B - Chapel Hill to Spring Hill | E/B – N/B | 19 | 27 | X | X | 16 | 33 | 9 | 57 | +3.1 | +19% | X | X |
| C - Toowong to Newmarket | E/B – N/B | 16 | 25 | X | X | 13 | 31 | 9 | 50 | +2.9 | +22% | X | X |
| **PM Peak Hour** | | | | | | | | | | | | | |
| **2014** | | | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | W/B – S/B | 21 | 35 | 12 | 59 | 20 | 38 | 12 | 62 | +1.6 | +8% | +0.5 | +4% |
| B - Chapel Hill to Spring Hill | W/B – S/B | 20 | 27 | X | X | 19 | 29 | 11 | 49 | +1.4 | +7% | X | X |
| C - Toowong to Newmarket | W/B – S/B | 16 | 27 | X | X | 15 | 28 | 9 | 50 | +0.8 | +5% | X | X |
| **2026** | | | | | | | | | | | | | |
| A - Centenary Br. to Land Br. | W/B – S/B | 20 | 37 | 10 | 69 | 21 | 36 | 11 | 66 | -0.2 | -1% | -0.4 | -4% |
| B - Chapel Hill to Spring Hill | W/B – S/B | 21 | 26 | X | X | 20 | 27 | 11 | 48 | +0.4 | +2% | X | X |
| C - Toowong to Newmarket | W/B – S/B | 17 | 26 | X | X | 17 | 25 | 9 | 48 | -0.2 | -1% | X | X |

**Table Note**:

Source: Northern Link Traffic Model

Indicative Travel Time from Indooroopilly without Northern Link (2026 AM Peak)


Indicative Travel Time from Indooroopilly with Northern Link (2026 AM Peak)




**LEGEND**

- Travel Time (mins) < 10
- 10 < Travel Time (mins) < 20
- 20 < Travel Time (mins) < 30
- 30 < Travel Time (mins) < 40
- 40 < Travel Time (mins) < 50
- 50 < Travel Time (mins)

NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT - SUPPLEMENTARY REPORT

**Figure 4-9**

**Change in 2026 Morning Peak Travel Time From Indooroopilly with the Project**

Northern Link

SKM Connell Wagner JOINT VENTURE

### 4.1.8 Local Access Effects

As the Northern Link Project does not have local connections there would be no effect on local access in the Toowong and Kelvin Grove precincts. The relevant areas for consideration of local access effects are:

- Western Freeway precinct (the area west of Frederick Street and including the Mt Coot-tha Botanic Gardens, Anzac Park and the Toowong Cemetery); and
- Inner City Bypass precinct.

#### Western Freeway precinct

As with the EIS Reference Project, the Project would retain the existing road network arrangements from the eastern end of the Western Freeway at the Mt Coot-tha Roundabout to the Toowong Roundabout. The existing access to the Mt Coot-tha Botanic Gardens, Anzac Park and the Toowong Cemetery through connections with Mt Coot-tha Road, Dean Street, Miskin Street and Frederick Street would not alter with the Project during operations.

The effects of reduced traffic volumes east of the Northern Link connections on the Western Freeway and at the Mt Coot-tha Road intersection and Toowong roundabout would benefit local traffic operations and access in this precinct.

#### ICB

The proposed connection of the Project with the ICB is similar to the EIS Reference Project. As identified in Section 3.2.1 of the Supplementary Report, the layout of the ICB connection[7] remains as presented in the EIS Reference Project[8] except that the outer and centre lanes of the 3-lane ICB westbound continue as the ICB with only the inner lane dedicated to the Northern Link tunnel.

The effect of these changes to the lane marking is to give priority to the continuation of the ICB traffic lanes. The connection with the ICB would maintain the existing connectivity of the ICB with Hale Street, Ithaca Street, Victoria Park Road and Kelvin Grove Road. Similarly, the existing connectivity of Hale Street with Musgrave Road and Kelvin Grove would remain unaltered.

#### Hospitals, Emergency Services Vehicles and Rail Services and Infrastructure

As with the EIS Reference Project the Project would not directly impact on access to hospitals, rail services and infrastructure and emergency service vehicle routes. Significant travel time savings would be available for access from the west to the Royal Brisbane Hospital at Herston via the Project. Forecast traffic reductions on the surface road network would reduce response times for emergency vehicles generally in the inner west.

### 4.1.9 Bus Travel Effects

The Project would provide buses travelling via Moggill Road, Coronation Drive and Milton Road with improvements in travel time and travel time reliability due to changed traffic conditions and reduced traffic volumes on the road network in the inner west.

The Project would complement Coronation Drive as the primary route for bus movements. While a policy decision has yet to be made on the provision of an inbound bus lane or T3 lane, the opportunity to re-introduce

[7] Supplementary Report Volume 2 Project Design, Planning Layout 10 of 10 (Drawing No.EIS-PL-10 Rev B)
[8] EIS Volume 2 EIS Reference Design, Planning Layout 11 of 11 (Drawing No. EIS-PL-11 Rev A)

bus priority on Coronation Drive has been included in the surface road network assumptions. This opportunity exists for implementation following the Project, and is supported by the submissions on the EIS. Bus services travelling along Milton Road and Coronation Drive would experience indicative travel time savings of approximately 5 minutes in the peak direction. There would be a minimal change in travel time during peak periods on Moggill Road.

The Project offers the opportunity to deliver a busway-type link for future cross-town bus services between key trip generators in the western and northern suburbs (e.g. Chermside to Indooroopilly, Indooroopilly to Australia TradeCoast) to travel via Northern Link and the Northern Busway.

Council is also in consultation with the Queensland Government to examine the potential for efficient and cost-effective bus connectivity between the Inner Northern Busway and the Project for the diversion of existing Rocket bus services that operate in peak periods between the western suburbs and the CBD. The Project however does not rely any additional connectivity being provided for the Coordinator-General's evaluation other than proposed direct access between the Western Freeway and ICB transport corridors.

The Project does not require any changes to the location of existing bus stops.

### 4.1.10 Active Transport

The potential effects of the Project on infrastructure for pedestrian and cycle movements are described below. Northern Link would not permit usage by pedestrians and cyclists.

#### Western Connection

The existing connectivity and function of the Western Freeway bikeway would be maintained as would the connectivity and functionality planned by DTMR for the cycle and pedestrian bridge.

#### Eastern Connection

The existing connectivity and functionality would be maintained.

#### Effect on Active Transport within the Inner West Transport Study Area

Traffic reductions, when compared to the scenario without Northern Link, on regional radial roads, city distributors, local streets, existing and planned cycle routes and Council bikeway/Greenway network would be in the order of 10-20%. Such traffic volume reductions would enable better access within the study corridor, through better movement of traffic, including for pedestrians and cyclists.

Several roads that would have functioned as connecting roads for the EIS Reference Project at Toowong and Kelvin Grove that catered for active transport users and were forecast to experience traffic volume increases, would have reduced traffic levels with the Project. Key examples include Jephson Street and Burns Road in Toowong and Kelvin Grove Road in Kelvin Grove. Croydon Street in Toowong is forecast to have a reduced increase in traffic volume with the Project compared to EIS Reference Project. The Project has no direct impact on existing or planned pedestrian crossing arrangements at the Milton Road/Croydon Street/Morley Street intersection or along Croydon Street.

Traffic reductions forecast with the project along Sylvan Road (i.e. -10% compared to the scenario without Northern Link in 2026) would enhance the amenity of this corridor which provides a key linkage for cyclists between the Western Freeway bikeway and Bicentennial Bikeway. Further information on proposed urban mitigation measures associated with the Project is included in Chapter 2.5 of the Supplementary Report.

### 4.1.11 Road Safety Effects

Estimated crashes without and with the Project for key elements of the road network have been calculated for comparison with the assessment provided for the EIS Reference Project as shown in **Table 4-23.** This has been based on estimates of vehicle kilometres of travel (VKT).

## Table 4-23 Estimated Crashes on Key Routes Without and With the Project

| Arterial | Section | 2007 | 2014 | | | | 2026 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Average Annual Crashes | Without Project | With Project | Difference | % Change | Without Project | With Project | Difference | % Change |
| Northern Link | All | - | - | 7 | +7 | | | 11 | +11 | |
| Coronation Drive | All | 257 | 55 | 50 | -4.9 | -8.9% | 59 | 52 | -7.17 | -12.1% |
| Milton Road | All | 188 | 46 | 44 | -2.1 | -4.6% | 47 | 45 | -2.30 | -4.8% |
| Moggill Road | Western Fwy Ramps to Toowong | 126 | 28 | 25 | -3.0 | -10.8% | 30 | 27 | -2.82 | -9.4% |
| Frederick Street | All | 24 | 5 | 5 | -0.2 | -4.2% | 6 | 5 | -0.48 | -8.6% |
| Rouen Road | All | 25 | 6 | 5 | -0.4 | -6.8% | 6 | 5 | -0.61 | -10.4% |
| Boundary Road | All | 34 | 7 | 7 | 0.0 | +0.7% | 7 | 7 | -0.25 | -3.4% |
| Sir Fred Schonell Drive | All | 44 | 10 | 10 | -0.1 | -0.5% | 10 | 11 | 0.37 | 3.6% |
| Coonan Street | Walter Taylor Bridge to Moggill Road | 97 | 20 | 20 | -0.1 | -0.7% | 20 | 20 | 0.09 | 0.5% |
| Western Freeway (1) | Moggill Road Ramps east for 2.75km | 27 | 6 | 6 | -0.8 | -13.0% | 7 | 6 | -1.16 | -15.8% |
| Western Freeway (1) | Mt Coot-tha Road west for 0.75km | 19 | 5 | 6 | +1.1 | +24.8% | 5 | 7 | 1.60 | 30.8% |
| Total | | 841 | 188 | 185 | -3.1 | -1.6% | 198 | 196 | -2.1 | -1.1% |

**Table Note:** Source BCC 2006 (crash data), Northern Link Traffic Model (VKT, Distance)

(1) Crash rates analysed for individual sections of Western Freeway.

The Project is forecast to result in a reduction of forecast crashes on major routes in the inner west in 2014 and 2026 of 3.1% and 1.1% respectively. The reduction in forecast crashes is lower than the EIS Reference Project (which had comparative forecast crash reductions of 3.4% in 2014 and 2.0% in 2026) as crash reductions on the surface network are not as significant with the lower quantum of traffic diverted to the higher quality road network.

### 4.1.12 Construction Impacts

The Project would require a worksite at the Western Freeway for the launching of the TBMs and the handling of spoil from the tunnels within an acoustic shed. The location, extent, and access arrangements for the worksite would be essentially as described in the EIS for the EIS Reference Project.

However, no worksites would be required at Milton Road or Kelvin Grove Road. As a result, no construction traffic impacts are expected in these areas. In particular, the changes in local access, public transport and active transport routes in the Milton Road and the Kelvin Grove Road areas identified for the EIS Reference Project would not occur with the Project.

Overall, the impact of the Project on local access, public transport and active transport would be limited to temporary realignments of traffic lanes at the Mount Coot-tha Roundabout and on the ICB as identified for the EIS Reference Project but without the associated construction effects identified in the EIS for the local connecting ramps. The proposed traffic management and staging arrangements for the Project are identified in the Project Design drawings in Volume 2 of the Supplementary Report (Drawings EIS-TM-01 Rev B to EIS-TM 08 Rev B). Key elements noted on these drawings include:

- connectivity of existing pedestrian and cycleways would be maintained during construction;
- existing bus stops would be relocated where necessary during construction to meet the requirements of TransLink; and
- detailed design would be subject to maximising existing and temporary pavement to maintain exiting lane capacities though all stages of construction.

Traffic generation from the Western Freeway and Inner City Bypass construction areas, particularly truck movements associated with spoil haulage, would be essentially as described in the EIS, although there would be no spoil haulage trips to and from the Western Worksite from the Milton Road worksite to access the proposed spoil conveyor. Spoil haulage traffic generation from the Milton Road and Kelvin Grove worksites would be removed. This represents a significant decrease in impacts on traffic operations compared to those described in the EIS, both locally and regionally. The total number of spoil haulage movements required throughout the construction period would be reduced by approximately two-thirds.

Most of this decrease would be on the Port of Brisbane route, for which Northern Link haulage traffic would be reduced by over 90% to only 3 truck movements in each direction per day. The potential impacts of the Project on this route, including the Inner City Bypass, Kingsford Smith Drive and the Gateway Motorway, would be minimal.

Usage of the Swanbank route would be similar to, but slightly less than, the EIS figures, with an estimated 58 truck movements per day in each direction. A significant change would be that the removal of the Milton Road worksite would remove any need for haulage vehicles to turn through the Moggill Road interchange on the

Western Freeway in order to access the Western Freeway worksite and the proposed spoil conveyor to the quarry.

The recommended construction mitigation measures described in Section 5.7.9 of the EIS to reduce construction effects on traffic and other road users during the construction phase remain appropriate for the Project.

### 4.1.13 Cumulative Effects with Potential Future Network Upgrades

An assessment of the cumulative effects of the Project in combination with potential corridor options under consideration in the Western Brisbane Transport Network Investigation (WBTNI) has been carried out. At the time of preparation of the Northern Link EIS Supplementary Report in early 2009, the findings of the WBTNI had not been released and no new specific information on the WBTNI corridor options was available. Therefore, the same methodology and assumptions regarding WBNTI options as used in the EIS (Section 21.4.3) were applied in the analysis.

The WBTNI corridor options modelled in combination with the Northern Link Project were:

- Option 3: Toowong to Everton Park (new corridor).;
- Option 6: Everton Park to Kedron (Stafford Road corridor);
- Option 15: North West Transport Corridor (Everton Park to Carseldine – existing preserved corridor); and
- Option 5: TransApex East-West Link (Toowong to Buranda).

All links have been modelled as tolled links operational in 2026. Demand matrices were established based on inclusion of the WBTNI project infrastructure in the network. With the inclusion of several major tolled links branching from the Western Freeway in 2026 (Option 3: Toowong to Everton Park, Option 5: TransApex East-West Link and Northern Link), it was assumed that the Western Freeway and Centenary Motorway, including the Centenary Bridge, would operate as three general purpose lanes in each direction for this assessment.

**Table 4-24** presents the findings of the cumulative effects test of the WBTNI corridor options (as described above) with Northern Link for 2026 based on preliminary modelling.

**Table 4-24 Cumulative Effect of Northern Link Project with WBTNI Options**

| Network Scenario | 2026 Northern Link Average Weekday Traffic | Change in Northern Link Forecast Average Weekday Traffic | % Reduction in Forecast Traffic Volume on Northern Link Project |
|---|---|---|---|
| Northern Link Project Only | 48,800 | - | - |
| Northern Link Project plus WBNTI Options 3, 6, 15 and 5 (1) | 42,600 | -6,140 | -12.6% |

**Table Notes:**

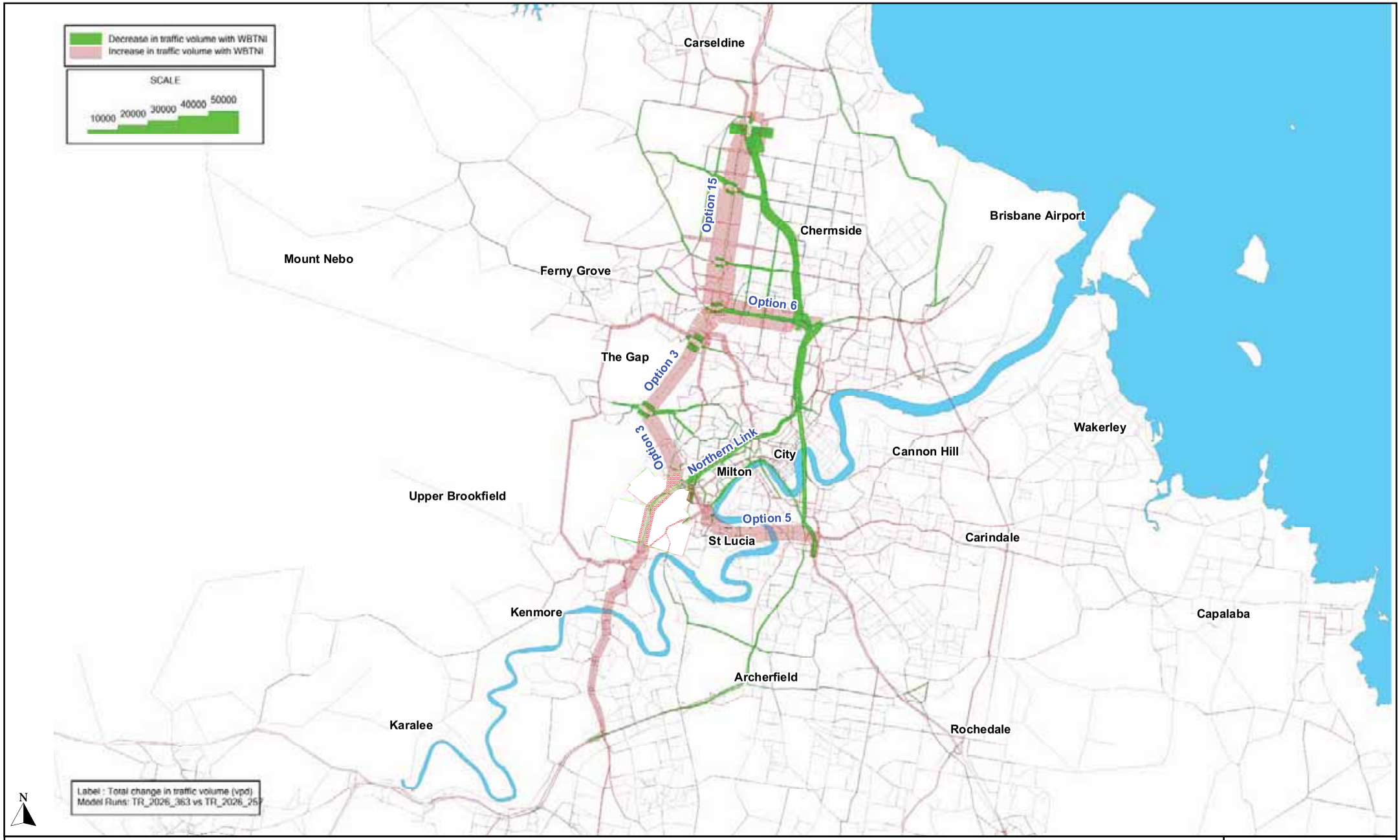
1. The WBTNI project representations are based on MapInfo coding provided by the State for use within Council's Northern Link Traffic Model. Preliminary modelling is based on an indicative 50c/km toll rate (in 2008 dollars) for WBTNI Options 3, 6 and 15, and a toll of $3.93 on E-W link and Northern Link.

**Figure 4-10** presents the indicative traffic flow changes within the network in the cumulative scenario with Northern Link and WBTNI options 3, 6, 15 and 5; compared to the Northern Link only project case. **Figure 4-11** shows the indicative daily travel patterns that would be expected for use of Northern Link in the cumulative scenario. Key findings for this cumulative effects assessment are:

- As there is some overlap of the cross-city (west-east, west-north and west-south) functions performed by the WBTNI Options and Northern Link, a small reduction in traffic use of Northern Link is forecast. This

preliminary modelling indicates that the average weekday traffic use of the Project volume would reduce by 12.6%, from 48,800 vehicles per day in 2026 to 42,600 vehicles per day. This diversion rate is similar to that forecast for the EIS Reference Project.

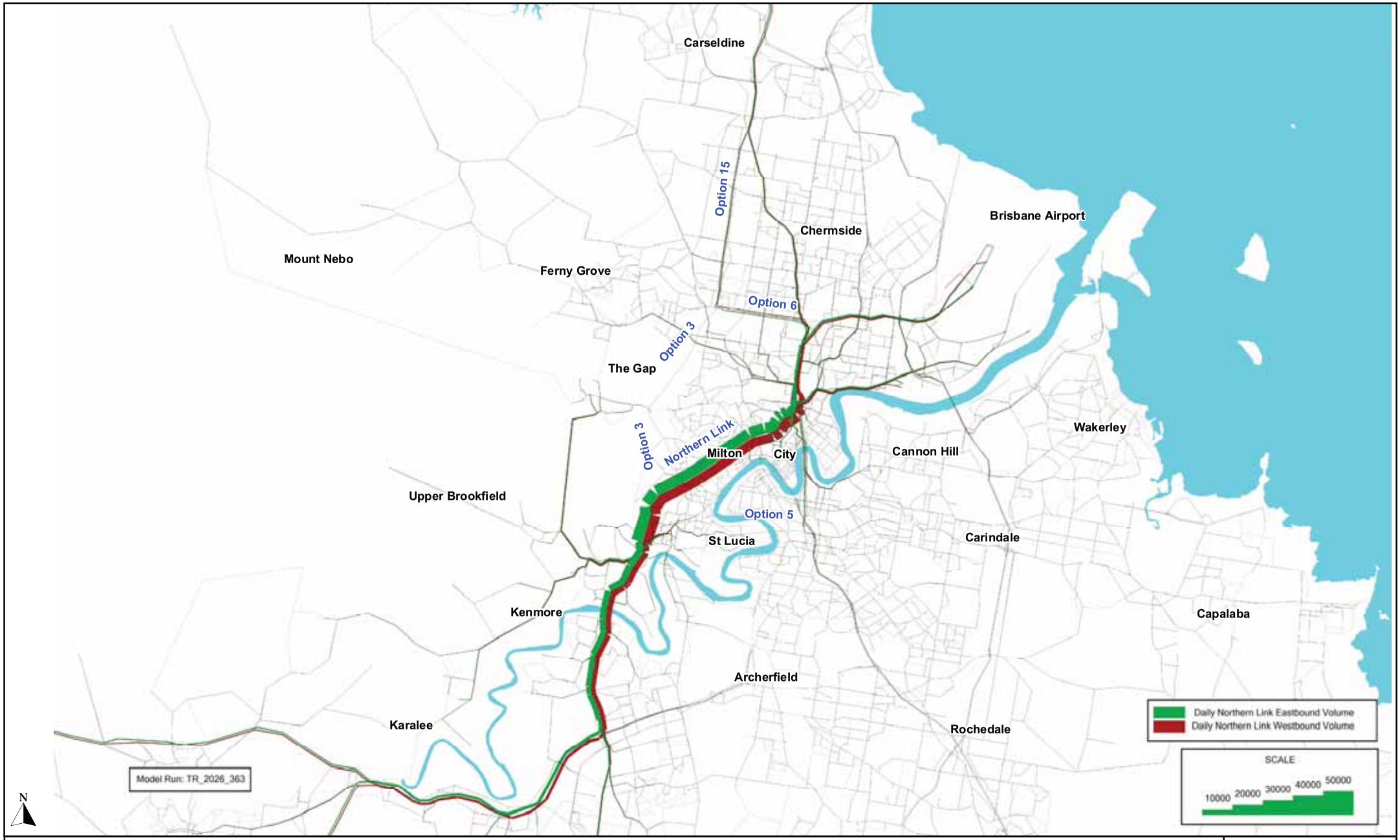
- Overall the predominant cross-city function provided by Northern Link between the west, east and north would be maintained. As illustrated in **Figure 4-11,** the Project would also function as a feeder within a west to north travel route via ICB, Airport Link, WBTNI Option 6 (Stafford Road upgrade) and WBTNI Option 15 (North-West Transport Corridor).
- Key roads such as ICB, Gympie Road, and Gateway Motorway north are forecast to experience traffic reductions in the cumulative scenario. Increased traffic volumes are forecast for the Western Freeway and Centenary Highway (in line with the capacity upgrades that would be implemented on these corridors to feed a combination of Northern Link and WBTNI project 3).
- Preliminary testing of cumulative effects indicates minimal change to the local streets and city distributors in the Inner West with the combination of the Northern Link Project and the WBTNI projects.




NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT - SUPPLEMENTARY REPORT

Figure 4-10

**Effect of WBTNI Options on Network including the Project**




NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT - SUPPLEMENTARY REPORT

**Figure 4-11**

**Indicative 2026 Travel Patterns for the Project with WBTNI Options**

## 4.2 Geology and Soils

### 4.2.1 Settlement

Without the Kelvin Grove Connection the Project tunnels would be deeper through Red Hill and remove the short sections of potentially greater settlement risk in the vicinity of Hayward Street and Musgrave Road. Potential settlement in the eastern (Red Hill and Kelvin Grove) section of the Project would no longer exceed 10mm, assessed as essentially negligible. The alteration to settlement potential is shown figuratively in **Volume 2 – Project Design**, of this Supplementary Report

### 4.2.2 Contaminated Land

The EIS listed 17 potentially contaminated properties on the Environmental Management Register (EMR) as being potentially disturbed by the EIS Reference Project. With the Project, four of these properties would no longer be affected by surface work construction activities. These land parcels should still be considered in the detailed design of the Project tunnels as identified in **Table 4-25.**

**Table 4-25 Land Parcels for Consideration During Construction of the Project**

| Project Corridor Section | Land Parcels for Consideration During Construction of the Project | EMR (Notifiable Activity) | EIS Reference Construction Activities | Project Construction Activities |
|---|---|---|---|---|
| Western end | Lot 1 on Plan RP868488 – Mt Coo-tha Reserve (200 Mt Cootha Rd Toowong) | Mineral Processing | Surface Works & Interface Earthworks | Surface Works & Interface Earthworks |
| | Lot 3 SP159806 (216 Brosley Rd Toowong) | Landfill | Interface Earthworks | Interface Earthworks |
| | Lot 1 RP18899 - Mt Coo-tha Reserve & Anzac Park (108 Dean St Toowong) | Landfill | Surface Works, Transition Structure, Interface Earthworks, Cut and Cover Tunnel, & Cross Passages | Surface Works, Transition Structure, Interface Earthworks, Cut and Cover Tunnel, & Cross Passages |
| | Lot 5 SL12786 – Toowong Cemetary (124 Birdwood Tce Toowong) | Petroleum Product or Oil Storage | TBM Excavated Driven Tunnel & Cross Passages | TBM Excavated Driven Tunnel & Cross Passages |
| | Lot 3 RP886311 (601 Milton Rd Toowong) | Petroleum Product or Oil Storage | Elevated Structure & Surface Works | Nil |
| | Lot 5 RP127711 (581 Milton Rd Toowong) | Service Station | Elevated Structure & Surface Works | Nil |
| | Lot 1043 SL7078 – Toowong Bus Depot (29 Miskin St Toowong) | Petroleum Product or Oil Storage | Nil | Nil |
| | Lot 1042 SL9242 Park-n-Ridge (27 Miskin St Toowong) | Hazardous Contaminant Site | Nil | Nil |
| Eastern End | Lot 1 RP181929 (43 Musgrave Rd Red Hill)* | Service Station | Surface Works | Nil |
| | Lot 1 RP142701 (6 Victoria St Kelvin Grove) | Hazardous Contaminant Site | Nil | Nil |

| Project Corridor Section | Land Parcels for Consideration During Construction of the Project | EMR (Notifiable Activity) | EIS Reference Construction Activities | Project Construction Activities |
|---|---|---|---|---|
| | Lot 1 RP891412 (113 Kelvin Grove Rd Kelvin Grove) | Dry Cleaning | Nil | Nil |
| | Lot 556 SP133445 (137 Kelvin Grove Rd Kelvin Grove) | Landfill | Nil | Nil |
| | Lots 1,2 & 3 SP179651 (150 Kelvin Grove Rd Kelvin Grove E) | Site of Council Interest | Nil | Nil |
| | Lot 2 SP113018 (39 Kelvin Grove Rd Kelvin Grove) | Railway Yards | Nil | Nil |
| | Lot 4 SP113018 (29 Gilchrist Ave Herston) | Railway Yards | Nil | Nil |
| | Lot 32 SP122215 (Gilchrist Ave Herston) | Railway Yards | Surface Works | NIL |
| | Lot 5 SP123915 (18 Bowen Bridge Rd Herston) | Hazardous Contaminant Site | Surface Works & Interface Earthworks | Surface Works & Interface Earthworks |

## 4.3 Hydrology

### 4.3.1 Model Predictions

With the vertical alignment lowered in the Red Hill area the drawdown cone modelled as indicating the tunnel's effect on groundwater, would assume a marginally steeper gradient at the eastern end but would not be extended. This is a minor change.

### 4.3.2 Groundwater Depletion or Recharge

Due to smaller tunnel surface area by removal of entry/exit ramps, groundwater inflow to the tunnel would be expected to be marginally lower but continued use of the estimated 4 litres per second is proposed as a conservative estimate.

### 4.3.3 Settlement

Settlement due to groundwater drawdown along the mainline tunnel alignment would not change except in the area of Hayward Street where it would be decreased by removal of the Kelvin Grove Road ramps. Risk of settlement from groundwater depletion would be removed from those areas above the alignment of the Toowong and Kelvin Grove entry/exit ramps as shown in **Volume 2 – Project Design, of this Supplementary Report**.

### 4.3.4 Construction Water Impacts

Removal of the Toowong and Kelvin Grove entry/exit ramps from the Project would decrease the volume of water required for construction as identified in Chapter 3, Section 3.3.3 of the Supplementary Report.

## 4.4 Air Quality

A Supplementary Air Quality Assessment was undertaken to determine if there are any significant implications for the Project in terms of air emissions from the Project and hence air quality and subsequent health risks as presented in **Appendix E**. The report provides a review of changes in the modelled traffic numbers, based on the updated Northern Link Traffic Model, presented in Section 4.1. The health risk assessment for the EIS Reference Project focused on the change in air quality rather than the absolute values, all of which showed

compliance with air quality goals. The assessment focuses on changes in air quality from the Project and the updated traffic model.

### 4.4.1 Changes from the Updated Traffic Model

Most of the trends are for less traffic with the updated model and less change between the build and no build cases. There are no absolute increases in total traffic for the EIS Reference Project, with the updated traffic model, compared to the no build case greater than those assessed in the EIS. On the basis of the new traffic data, "worst-case" air quality impacts of the EIS Reference Project option remain as presented in the EIS.

Also, on the basis of the new traffic data, the traffic numbers in the tunnel were less than those predicted in the EIS and hence the predicted "worst-case" impact of emission from the ventilation outlets also remain as presented in the EIS.

### 4.4.2 Differences between the EIS Reference Project and the Project

The differences between the EIS Reference Project and the Project using the updated modelling data are summarised in **Table 4-26,** including the same data as presented in the EIS prior to the updated modelling.

- **Table 4-26 Comparison of Northern Link project scenarios – Differences in AADT[1] Volumes**

| Road Section | AADT volume Differences as presented in the EIS "With" vs "Without Project" | AADT volume Differences "With EIS Reference Project" vs "Without Project" based on the updated model | AADT volume Differences "With Project" vs "Without Project based on the updated model | AADT volume Differences Project vs EIS Reference Project based on the updated model |
|---|---|---|---|---|
| 2014 | Column 2 | Column 3 | Column 4 | Column 5 |
| Kelvin Grove Road (north of Herston Road) | +3780 | +5310 | +1580 | -3550 |
| Inner City Bypass (east of Kelvin Grove Road) | +16900 | +14490 | +19730 | +5240 |
| Hale Street | -2580 | -2600 | -5200 | -2600 |
| Mount Coot-tha Road | -7430 | -7710 | -3750 | +3960 |
| Milton Road (west of Torwood Road) | -6660 | -8150 | -2870 | +5280 |
| Western Freeway (South of Mount Coot-tha Road) | +22830 | +21840 | +21100 | -740 |
| 2026 | | | | |
| Kelvin Grove Road (north of Herston Road) | +5310 | +5050 | +240 | -4810 |
| Inner City Bypass (east of Kelvin Grove Road) | +24540 | +23360 | +33380 | +10020 |
| Countess Street | -3100 | -1680 | -2150 | -470 |
| Simpson Road | -3970 | -4380 | -1810 | +2570 |
| Mount Coot-tha Road | +20 | -5840 | -900 | +4940 |
| Western Freeway (South of Mount Coot-tha Road) | +30540 | +31310 | +30090 | -1220 |

Table Notes

(1) Average Annual Daily Traffic

Positive values indicate that the respective scenario will cause an increase in traffic on that road section and negative values indicate a decrease. Column 4 compares the EIS Reference Project with the Project based on the updated traffic modelling. Positive values indicate that the Project increases traffic volumes relative to the EIS Reference Project numbers (including from a negative base) and negative values that the Project decreases traffic volumes relative to the EIS Reference Project numbers (including from a positive base).

The table shows that there is still a benefit for Milton Road and Mt Coot-tha Road in 2014, although it is not as great as that predicted in the EIS. By 2026, the benefit to Mt Coot-tha Road is very marginal and in the EIS there was no benefit predicted.

For the ICB, there is a predicted greater increase in traffic in 2014 and 2026 for the Project case that is significantly more than that predicted in the EIS project case (Column 1), including with the reduction provided for the EIS Reference Project (Column 2) through the updated modelling. The difference in 2026 is greater than any other traffic difference presented in the EIS and this road has therefore been remodelled using the roadway model Cal3qhcr.

### 4.4.3 Impact Assessment and Conclusions

Predicted maximum roadside concentrations for the ICB east of Kelvin Grove Road in 2026 are summarised in **Table 4-27**. Concentrations of carbon monoxide (CO), nitrogen dioxide ($NO_2$), particulate matter less than 10 micrometres in diameter ($PM_{10}$) have been predicted at kerbside and at 10, 30 and 50 metres from the kerb as done for the EIS.

**Table 4-27 Predicted Roadside Concentrations With and Without the Project Adjacent to ICB East of Kelvin Grove Road 2026**

| Distance from Kerb | 8-hour CO (mg/m3 ) | | 1-hour $NO_2$ (µg/m3) | | Annual $NO_2$ (µg/m3) | | 24-hour $PM_{10}$ (µg/m3) | | Annual $PM_{10}$ (µg/m3) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Without Project | With Project | Without Project | With Project | Without Project | With Project | Without Project | With Project | Without Project | With Project |
| W_50m | 0.19 | 0.25 | 15.6 | 20.4 | 4.2 | 5.2 | 1.4 | 1.8 | 0.5 | 0.7 |
| W_30m | 0.25 | 0.33 | 20.9 | 27.3 | 5.8 | 7.2 | 1.9 | 2.4 | 0.7 | 0.9 |
| W_10m | 0.44 | 0.57 | 26.0 | 34.1 | 10.1 | 12.6 | 3.1 | 4.0 | 1.2 | 1.6 |
| W_Kerb | 0.80 | 1.06 | 34.6 | 41.6 | 19.6 | 24.6 | 5.2 | 6.9 | 2.4 | 3.1 |
| E_Kerb | 0.87 | 1.11 | 36.5 | 46.9 | 17.6 | 21.7 | 5.8 | 7.4 | 2.1 | 2.7 |
| E_10m | 0.45 | 0.57 | 28.2 | 36.5 | 8.2 | 10.3 | 3.0 | 3.9 | 1.0 | 1.3 |
| E_30m | 0.26 | 0.34 | 21.7 | 28.1 | 4.6 | 5.8 | 1.7 | 2.3 | 0.5 | 0.7 |
| E_50m | 0.20 | 0.26 | 15.6 | 20.2 | 3.3 | 4.2 | 1.3 | 1.6 | 0.4 | 0.5 |

**Table 4-28** compares the difference between the Project and Without the Project based on the updated model case, at 10 metres from the ICB (where the difference is greatest) with the equivalent predictions in the EIS and with maximum difference anywhere along the route assessed in the EIS in terms of health risk. This was the section of the Western Freeway South of Mt Coot-tha Road in 2016, 2021. For the Project option, the maximum difference is next to the ICB in 2026.

The differences in pollutant levels between the Project and Without the Project based on the updated model options decrease with distance from the road and at greater than 50 metres the differences will be barely discernible. The assessment has therefore focused on the impacts at 10 metres from the road. In reality no-one

is living this close to the Freeway or the ICB; however this distance was used in the EIS HRA to provide an extreme worst-case.

- **Table 4-28 Predicted Maximum Differences in Concentration at 10 metres from the ICB Kerb for the Project compared with the EIS Reference Project and the worst case predicted in the EIS.**

| | 8-hour CO (mg/m3 ) | 1-hour $NO_2$ (µg/m3) | Annual $NO_2$ (µg/m3) | 24-hour $PM_{10}$ (µg/m3) | Annual $PM_{10}$ (µg/m3) |
|---|---|---|---|---|---|
| Project vs Without Project (2026) next to ICB | 0.13 | 8.3 | 2.5 | 1.0 | 0.4 |
| EIS Reference Project vs Without Project (2026) next to ICB | 0.1 | 6.1 | 1.7 | 0.7 | 0.3 |
| EIS Reference Project vs Without Project (2016 and 2021) Western Fwy EIS used for HRA) – Worst Case | 0.3 | 11.74 | 7.50 | 2.26 | 0.83 |

The differences in pollutant levels at 10 metres from the ICB for the Project compared to the Without the Project are all greater than the levels predicted in the EIS for that section of the route. However they are less than the levels predicted in the EIS close to the Western Freeway used for the worst-case health risk assessment (HRA).

The comparisons are complicated by the decrease in individual vehicle emission rates between 2016 and 2026. Thus although the 2016 EIS traffic number increases on the Western Freeway were less than those now predicted in 2026 on the ICB, the emissions per vehicle were greater in 2016 and consequently the predicted impacts are greater.

For example, the predicted increase in maximum 1-hour $NO_2$ at 10 metres from the ICB is 8.3 µg/$m^3$ for the Project in 2026. This is less than the predicted maximum increase of 11.74 µg/$m^3$ assessed for health risk effects in the EIS for the Reference Project in 2016 at a distance of 10 metres from the Western Freeway south of Mt Coot-tha Road.

In summary, while there will be differences in the traffic distributions with the Project, the "worst-case" health impacts would be no greater than those identified in the EIS for the Reference Project.

## 4.5 Noise and Vibration

This analysis is based on revised traffic data for the Project contained within Chapter 4.1 of this Supplementary Report and presented by comparison with the findings of the earlier analysis of the EIS Reference Project.

### 4.5.1 Construction Noise and Vibration

The extension of the roadworks on the Western Freeway for a further 100m would not alter the noise impacts as the distance from nearest residences is more than 110m, similar to separation distances from other residential areas along the Western Freeway. Based on the distance between the work area and the nearest residences in Crag Road, typical construction external noise levels at the nearest sensitive receiver from the Project work at this location would be in the range of 47 dBA (eg water-truck) to 56 dBA (eg excavator) LAeq. Therefore, at times the Northern Link construction noise may marginally exceed the daytime Noise Goal of 55 dBA LAeq.

Mitigation measures referred to in the EIS applicable to other receiver areas surrounding the Western Freeway connection (eg Wool Street) would be applied to these works and receivers where appropriate and based on predictive modelling undertaken for the detailed design of the project.

The Project construction sites and surface works associated with the Toowong and Kelvin Grove local connections would not be required. Therefore, all noise and vibration impacts contained in the EIS associated with these construction sites/surface works would no longer occur. This would have greatest benefit for residential areas directly adjacent to the Milton Road and Kelvin Grove worksites.

Furthermore, regenerated noise and vibration from the (roadheader) driven tunnelling associated with these 2 connections would not occur. For the southern section of Frederick St where only roadheader impacts were predicted in the EIS, this impact would be completely removed. At the northern end of Frederick St (and east thereof where the on/off ramp tunnels from the EIS Reference Project begin to run parallel with the mainline tunnels), there would be little change from the impacts in the EIS as the (TBM driven) mainline tunnel predictions were greater than the on/off ramp levels that are now removed.

With removal of the Kelvin Grove local connections the depth of the mainline tunnels would alter as indicated in Table 3-1. The greater depth of the mainline tunnels would mean significant reductions in regenerated noise and vibration in the shallowest areas. Vibration levels would approximately halve if the tunnel depth went from 10m to 15m and there would be a "noticeable" (approximately 5dBA) reduction in regenerated noise level over the same increase in depth. At the greater depths (30m to 50m), there would be minimal changes (for a 5m change in depth) to the predictions contained in the EIS for the mainline tunnels.

Changes in road traffic noise due to spoil haulage have been predicted based on the revised traffic data and the truck movement data contained within the EIS. The revised predictions are shown in **Table 4-29**.

- **Table 4-29 Effect of Construction Truck Movements on Traffic Noise Levels along Spoil Routes**

| Roadway | Road Section | Change in $L_{A10(18hour)}$ Traffic Noise Level (dBA) | |
|---|---|---|---|
| | | EIS Reference Project (with local connections) | The Project (without the local connections) |
| Mt Coot-tha Rd | Western Fwy to Frederick St | +0.2 | 0 |
| Western Fwy | West of Mt Coot-tha Rd | +0.1 | +0.1 |
| Milton Rd | Gregory St to Croydon St | +0.2 | 0 |
| Kelvin Grove Rd | ICB to Victoria St | +0.1 | 0 |
| ICB | Kelvin Grove Rd to Kingsford Smith Dr | +0.4 | +0.2 |
| Kingsford Smith Dr | ICB to Gateway Mwy | +0.2 | +0.1 |

The results in the table indicate that, compared to the EIS Reference Project, construction traffic noise will not change or very negligibly decrease from the EIS Reference Project levels.

### 4.5.2 Operational Noise and Vibration

The revised traffic data were used to estimate (via spreadsheet calculations) the changes in the predicted Year 2026 road traffic noise levels modelled for the EIS Reference Design as they relate to the two noise barrier options investigated in the EIS, being the "Planning" Level and the "Status-Quo" Level.

### 4.5.3 Changes to Planning Level Noise Barriers

For most road segments, the change in the predicted Year 2026 $L_{A10(18hour)}$ noise level was less than ±0.5 dBA. Roads with more significant changes in $L_{A10(18hour)}$ noise levels, based on the revised traffic data, are summarised in **Table 4-30**.

- **Table 4-30 Predicted Change in 2026 $L_{A10(18hour)}$ Noise Levels for the Project Compared to EIS Reference Project.**

| Road | Road Segment | Change in $L_{A10(18hour)}$ [1] |
|---|---|---|
| ***Western End*** | | |
| Croydon St | All | -0.7 to -1.6 (-1.2) |
| Dean St | Wool St to Mt Coot-tha Rd | +1.0 |
| Jephson St | Sylvan Rd to Augustus St | -0.8 |
| Morley St | Gregory St to Darce St | +0.6 |
| Mt Coot-tha Rd | Richer St to Western Fwy | +0.4 to +1.5 (+1.1) |
| Scenic Dr | Mt Coot-tha Rd to Sir Samuel Griffith Dr | +2.8 |
| Sir Samuel Griffith Dr | All | +1.2 to +1.3 (+1.2) |
| Sylvan Rd | All | +0.6 to +1.4 (+1.0) |
| Tunnel off-ramp | To Western Fwy | -0.6 |
| Western Fwy | Near roundabout | +1.2 to +1.5 (+1.3) |
| ***Eastern End*** | | |
| Countess St | All | +1.5 |
| ICB on-ramp | From Kelvin Grove Rd | +1.0 |
| ICB on-ramp | From Musgrave Rd | +1.4 |
| Kelvin Grove Rd | Blamey St to Victoria St | -0.4 to -1.4 (-0.9) |
| Kelvin Grove Rd | Victoria St to Musk Ave | +0.4 to +0.6 (+0.5) |
| Kelvin Grove Rd | Ithaca St to Musk Ave (outbound only) | +0.6 to +1.3 (+0.9) |
| Kelvin Grove Rd | Ithaca St to College Rd | -0.3 to -1.0 (-0.7) |
| Musgrave Rd | Petrie Tce to Lower Clifton Tce (outbound only) | -0.7 to -1.4 (-1.0) |
| Musgrave Rd | Exit to Kelvin Grove Rd on-ramp | -0.4 to -4.6 (-2.6) |

Note 1 Average change in $L_{A10(18hour)}$ is shown in brackets.

Planning Level noise barriers recommended in the EIS along Frederick Street, Milton Road and Croydon Street would not be required due to the absence of the Toowong connection. For the Western Freeway, the predicted change in noise level is less than 0.5 dBA except near the Mt Coot-tha Road roundabout. Based on the 3D modelling conducted for the EIS Reference Project and this predicted (marginal) increase, all noise sensitive locations adjacent to the Western Freeway are still predicted to comply with DTMR' 68 dBA $L_{A10(18hour)}$ planning noise level with noise levels of 61 dBA $L_{A10(18hour)}$ or less.

At the eastern end, no barriers along Kelvin Grove Road would be required, because of the Project, as there would be no road works in this area. The Planning Noise Level barriers directly adjacent the ICB would be required (refer to Appendix 18 of EIS Chapter 9B). The Planning Noise Level barriers designed for the EIS Reference Project adjacent the ICB are:

- already at the maximum considered height (8m) and therefore no increase in height will be required; or

- at a height of 6m where an increase in height in the order of 0.5m is likely to be sufficient to mitigate the marginal increase in predicted noise levels (in the order of 0.5 dBA – which is the cumulative effect of the on-ramps [increase up to 1.4 dBA] and the main ICB through-lanes [increase of less than 0.3 dBA]).

### 4.5.4 Changes to the 'Status Quo' Noise Barriers

The 'Status Quo' noise barriers consider the difference in predicted Year 2026 $L_{A10(18hour)}$ noise level for the "with Northern Link" and "without Northern Link" scenarios. The changes in 'Status Quo' noise levels from those documented for the EIS Reference Project have been predicted for the Project. For most road segments, the change in the 'Status Quo' noise levels was less than ±0.5 dBA. Roads with more significant changes, based on the revised traffic data, are summarised in **Table 4-31**.

**Table 4-31 Predicted Change in 'Status Quo' Noise Levels for the Project Compared to EIS Reference Project**

| Road | Road Segment | Change in $L_{A10(18hour)}$ [1] |
|---|---|---|
| Croydon St | Near Sylvan Rd | -1.6 |
| Croydon St | Near Milton Rd | -0.7 |
| Dean St | Wool St to Mt Coot-tha Rd | +1.4 |
| Jephson St | Sylvan Rd to Augustus St | -0.7 |
| Miskin St | Wool St to Mt Coot-tha Rd (northbound) | -1.1 |
| Miskin St | Wool St to Mt Coot-tha Rd (southbound) | +0.9 |
| Mt Coot-tha Rd | Richer St to Western Fwy | +0.8 to +1.8 (+1.1) |
| Mt Coot-tha Rd | Slip lane to Frederick St and overpass from Frederick St | +0.6 |
| Scenic Dr | Mt Coot-tha Rd to Sir Samuel Griffith Dr | +2.9 |
| Sir Samuel Griffith Dr | All | +1.2 to +1.3 (+1.2) |
| Sylvan Rd | All | +0.7 to +1.1 (+1.0) |
| Western Fwy | Near roundabout | +1.0 to +1.7 (+1.4) |
| Countess St | All | +1.6 |
| Hale St On-ramp | From Musgrave Rd | +0.9 |
| ICB On-ramp | From Musgrave Rd | +2.6 |
| Kelvin Grove Rd | Blamey St to Victoria St | -0.1 to -1.5 (-0.8) |
| Kelvin Grove Rd | Victoria St to Musk Ave | +0.4 to +0.8 (+0.6) |
| Kelvin Grove Rd | Ithaca St to Musk Ave (outbound only) | +0.4 to +1.1 (+0.8) |
| Kelvin Grove Rd | Exit to Hale St (southbound) to Ithaca St (inbound only) | +0.7 |
| Kelvin Grove Rd | Ithaca St to College Rd (inbound only) | -0.8 |
| Kelvin Grove Rd | On-ramp to ICB | +1.3 |
| Musgrave Rd | Hale St on-ramp (southbound) to Lower Clifton Tce (outbound only) | -1.2 |
| Musgrave Rd | Exit to Kelvin Grove Rd on-ramp | -0.3 to -5.3 (-2.2) |

Note 1 Average change in $L_{A10(18hour)}$ is shown in brackets.

At the western end, the 'Status Quo' noise barriers recommended in the EIS along Frederick Street, Milton Road and Croydon Street (refer to Appendix H7 of EIS Technical Report 9B), would not be required due to removal of the Toowong connection.

At the eastern end, no barriers along Kelvin Grove Road would be required as there would be no road works in this area. The 'Status Quo' noise barriers directly adjacent the ICB would be required (refer to Appendix 17 of EIS Chapter 9B). The 'Status Quo' noise barriers designed for the EIS Reference Project adjacent the ICB are:

- at heights of 5m to 6m where an increase in height in the order of 1m is likely to be sufficient to mitigate the marginal increase in predicted noise levels (in the order of 1 dBA – which is the cumulative effect of the on-ramps [increase up to 2.6 dBA] and the main ICB through-lanes [increase of less than 0.5 dBA]).

### 4.5.5 Road Network Remote from Portal Areas

Based on the revised traffic data, road traffic noise impacts on major roads remote from the portal areas has also been reconsidered.

**Table 4-32** summarises the predicted change in road traffic noise levels due to the Northern Link project for the EIS Reference Project and the Project when compared to the "Do Minimum" scenario.

**Table 4-32 Change in $L_{A10(18hour)}$ Noise Levels on Roads Remote from Portal Areas**

| Location | Change in $L_{A10(18hour)}$ Level | |
|---|---|---|
| | EIS Reference Project (with local connections) | The Project (without the local connections) |
| ***Roads in Vicinity of Western Portal*** | | |
| Western Fwy (Between Mount Coot-tha Rd and Moggill Rd) | +1.2 | +1.2 |
| Western Fwy (Between Moggill Rd off-ramps) | +1.0 | +0.8 |
| Mount Coot-tha Rd (Western Fwy to Frederick St) | -0.9 | -0.8 |
| Mount Coot-tha Rd (North of Western Fwy) | -2.0 | -0.9 |
| Frederick St | -0.8 | -0.5 |
| Milton Rd (Between Croydon St and Dixon St) | -0.4 | -0.3 |
| Milton Rd (Between Eagle Tce and Grimes St) | -0.4 | -0.2 |
| Coronation Drive (Between Park Rd and Lang Pde) | -0.9 | -0.7 |
| ***Roads in Vicinity of Eastern Portal*** | | |
| Hale St (South of Caxton St) | -0.1 | -0.1 |
| Musgrave Rd (West of ICB) | -0.2 | -0.1 |
| College Rd | +0.2 | -0.1 |
| Kelvin Grove Rd (North of Victoria St) | +0.6 | -0.1 |
| ICB (Between Kelvin Grove Rd and Bowen Bridge Rd) | +0.8 | +1.1 |

The results in the table show that the expected changes in the traffic noise as a result of the Project are considered to be minor and would not be generally noticeable from those documented in the EIS for the Reference Project.

## 4.6 Ecology

### 4.6.1 Vegetation Communities

There would be very little change to vegetation areas to be cleared for the Project. While there is some extension to the proposed works along the southern side of the Western Freeway the footprint for the Project has been reduced within the area of Anzac Park alongside the Western Freeway.

### 4.6.2 Significant Trees

The Crow's Ash at Toowong and other trees in Quinn Park would not be affected by the Project. Similarly the Project will have no impact on the fig trees along Kelvin Grove Road, in Marshall Park or in McCaskie Park.

### 4.6.3 Pest Animals

Spoil haulage from the eastern connections to the Port of Brisbane would be greatly diminished (23,000 truck trips fewer) so the potential to relocate red fire ants would be diminished. Appropriate care (*Plant Protection Regulation 2002*) would still be required with the remaining 2000 truck trips.

## 4.7 Planning and Land Use

### 4.7.1 Regional Planning Implications

The conclusions drawn in the EIS regarding regional planning and land use implications from the Project remain largely the same, although the Project, without the local connections will not provide a level of enhanced connectivity between activity centres, particularly to and from Toowong and the CBD as provided for with the EIS Reference Project. There will however remain some level of enhanced connectivity between centres able to access the connecting portals of the tunnels and also from the reduced congestion on the road network associated with the Project and identified in Section 4 of the Supplementary Report.

### 4.7.2 Local Planning and Land Use Implications

The land use impacts identified in the EIS with regard to the Toowong connection (Section 11.4.2) and the Northern connection (11.4.4) are no longer part of the Project. The Project would continue to support redevelopment and renewal within the inner western suburbs by reducing through traffic and improving local accessibility. The identified potential for construction works to impact on the amenity of residential areas is no longer relevant with regard to those areas identified in the EIS affected by the construction of the local connections in Toowong and Red Hill / Kelvin Grove.

### 4.7.3 Mitigation Measures

The mitigation measures identified in Table 11-7 Residential Areas, Table 11-8 Multi Purpose Centres (Commercial) and Table 11-9 (Community Use Areas) of the EIS are no longer considered relevant to the Project. The primary land use and planning associated objectives and performance criteria and mitigation measures from the Project remain with the design and construction of the Project within open space areas as identified in Table 11-10 of the EIS.

## 4.8 Cultural Heritage

### 4.8.1 Impact Assessment

An updated list of cultural heritage sites and associated potential for impact is provided in **Table 4-33**. The highlighted cells indicate changes from information presented in the EIS due to the removal of the local connections from Toowong and Kelvin Grove Road. In addition, Gona Barracks has been added to the table as an omission from the EIS. Further definition is also provided in the table regarding the distinction between a listed heritage property being directly above the mainline tunnel alignment and therefore affected through acquisition requirements for the volumetric part of the property and the listed property being outside the requirement for volumetric take but potentially within a zone of affectation from vibration.

## Table 4-33 Summary of Impacts on Registered Non-Indigenous Heritage Places

| No. | Place | Surface or Tunnel[1] | Heritage Status[2] | EIS Reference Project Affectation: | Project Affectation: |
|---|---|---|---|---|---|
| 1 | Mt Coot-tha Forest | Surface | QHR, Council | Direct impact from surface works | Direct impact from surface works |
| 2 | Anzac park, Toowong | Surface | Council | Direct impact from surface works | Direct impact from surface works |
| 3 | Toowong Cemetery | Tunnel | QHR, Council | Direct (above tunnel alignment) | Direct (above tunnel alignment) |
| 4 | Toowong Baptist Church | Surface | Council | Direct impact from surface works | No Direct impact from surface works. Not within potential zone of affectation from tunnel vibration [3]. |
| 5 | Memorial Crows Ash, Sylvan Rd Toowong | Surface | Council | Direct impact from surface works | No Direct impact from surface works |
| 6 | Baroona, 90 Howard St Paddington | Tunnel | RNE, QHR, Council | Direct (above tunnel alignment) | Direct (above tunnel alignment) |
| 7 | Rosalie Community Kindergarten & Preschool, Elizabeth St Paddington | Tunnel | RNE, QHR, Council | Indirect (not directly above tunnel alignment) | Indirect (not directly above tunnel alignment) |
| 8 | Rosalie RSL Hall, Elizabeth St Paddington | Tunnel | QHR, Council | Indirect (not directly above tunnel alignment) | Indirect (not directly above tunnel alignment) |
| 9 | Marist Bros Monastery, Fernberg Rd Paddington | Tunnel | Council | Indirect (not directly above tunnel alignment) | Indirect (not directly above tunnel alignment) |
| 10 | Church of the Sacred Heart, Given Terrace Paddington | Tunnel | RNE, Council | Indirect (not directly above tunnel alignment) | Indirect (not directly above tunnel alignment) |
| 11 | Sacred Heart Convent, Given Terrace Paddington | Tunnel | RNE, Council | Indirect (not directly above tunnel alignment) | Indirect (not directly above tunnel alignment) |
| 12 | Forester's Hall, Latrobe Terrace Paddington | Tunnel | QHR, Council | Direct (above tunnel alignment) | Indirect (not directly above tunnel alignment but within potential zone of affectation from tunnel vibration |
| 13 | St Brigid's Church, Musgrave Rd Red Hill | Tunnel | RNE, QHR, Council | Direct (above tunnel alignment) | Direct (above tunnel alignment) |
| 14 | Ithaca Embankments Nos. 3 & 4, Musgrave Rd Red Hill | Tunnel | QHR, Council | Direct (above tunnel alignment) | Direct (above tunnel alignment) |
| 15 | Terrace Shops and Flats, 91-109 Musgrave Rd Red Hill | Tunnel | Council | Indirect (not directly above tunnel alignment) | Not within potential zone of affectation from tunnel vibration. |
| 16 | St Brigid's Convent, Upper Clifton Terrace Red Hill | Tunnel | QHR, Council | Direct (above tunnel alignment) | Indirect (not directly above tunnel alignment but within potential zone of affectation from tunnel vibration |
| 17 | Fig Trees, Marshall Park, Kelvin Grove Rd | Surface | QHR, Council | Direct impact from surface works | No Direct impact from surface works |

| No. | Place | Surface or Tunnel[1] | Heritage Status[2] | EIS Reference Project Affectation: | Project Affectation: |
|---|---|---|---|---|---|
| 18 | McCaskie Park, Kelvin Grove Rd Kelvin Grove | Surface | Council | Direct impact from surface works | No Direct impact from surface works |
| 18 A | Gona Barracks | Tunnel | RNE, QHR, Council | Direct (above tunnel alignment) | Direct (above tunnel alignment) |
| 19 | Fig Trees, Kelvin Grov Rd opp. Normanby Hotel | Tunnel | QHR, Council | Direct (above tunnel alignment) | Indirect (not directly above tunnel alignment and not within potential zone of affectation from tunnel vibration. Potential impact from groundwater drawdown |
| 20 | Victoria Park, Herston | Surface | QHR, Council | Direct impact from surface works | Direct impact from surface works |

**Table Notes**
1 Indicates whether the item or place is affected by proposed surface works or tunnel works
2 RNE: Register of the National Estate; QHR: Queensland Heritage Register; Council: City Plan Heritage Schedule
3 the zone of affectation from vibration is discussed in section 12.2.3 of the EIS - For the shallowest (approx. depth to crown 8.5 m) sections of tunnel, given the predicted vibration level quoted above, the affected zone for cosmetic damage 'guide value' of 2mm/sec (for heritage structures) would have a maximum width of approximately 30 m either side of the tunnel centre line, and this width would diminish as the depth of cover increases

### 4.8.2 Impact Assessment – Western Freeway Connection

The potential for cultural heritage impacts from the Project at the Western Freeway connection remain the same as for the EIS Reference Project, including direct impact from surface works on:

- Mt Coot-tha Forest (State significance); and
- Anzac Park (local significance)

### 4.8.3 Impact Assessment – Toowong Connection

With removal of the Toowong connection the Project will have no impact from surface works on the locally registered Toowong Baptist Church or the Memorial Crows Ash.

### 4.8.4 Impact Assessment – Kelvin Grove Connection

With removal of the Kelvin Grove Road connection the Project will have no impact from surface works on the State registered Fig Trees in Marshall Park or the locally registered Fig Trees along Kelvin Grove Road in McCaskie Park.

### 4.8.5 Impact Assessment – ICB Connection

The potential for cultural heritage impacts from the Project at the ICB connection remain the same as for the EIS Reference Project, including direct impact from surface works on:

- Victoria Park (State significance)

### 4.8.6 Impact Assessment – TBM Driven Tunnels

The potential for cultural heritage impacts from the Project driven tunnels remain as identified in the EIS with the following clarifications and changes:

- Forester's Hall, Latrobe Terrace Paddington (State significance) is not directly above the tunnel alignment but may be within the zone of affectation from tunnel vibration;

- The Terrace Shops and Flats, 91-109 Musgrave Rd Red Hill (local significance) is beyond any likely zone of affectation from mainline tunnel vibration;
- St Brigid's Convent, Upper Clifton Terrace Red Hill (State significance) is no longer directly above the Project mainline tunnel alignment but may be within the zone of affectation from tunnel vibration;
- Gona Barracks (State significance)was incorrectly omitted from the EIS and is directly above the tunnel alignment; and
- Fig Trees, Kelvin Grove Rd opp. Normanby Hotel (State significance) are not directly above the tunnel alignment and not within potential zone of affectation from tunnel vibration. However the potential for impact from groundwater drawdown exists.

## 4.9 Social Environment

### 4.9.1 Social Impacts

The removal of the local connections at Toowong and Kelvin Grove will reduce many of the impacts identified in Chapter 13 of the EIS for communities in the vicinity of:

- Milton Road, Croydon Street, Jephson Street and Sylvan Road at Toowong; and
- Kelvin Grove Road, Lower Clifton Terrace, Upper Clifton Terrace and Victoria Street at Kelvin Grove.

#### Impacts by Location – Toowong Connection

The removal of the Toowong connection will avoid the construction and operation impacts for communities in the vicinity of Milton Road, Croydon Street, Jephson Street and Sylvan Road, outlined in Chapter 13 of the EIS for the EIS reference project.

In particular, the removal of the connection will avoid construction impacts on residential properties and local businesses at Milton Road, Valentine Street and Croydon Street and changes in access to local community facilities and pedestrian and cycle networks.

The removal of the connection will also avoid many of the operational impacts of the EIS reference project, including on local connectivity and community cohesion between neighbourhoods and to community facilities such as Toowong State School, local shops and public transport facilities. The removal of the connection will also avoid the partial loss of Quinn Park and impacts on amenity for park users.

Chapter 13 of the EIS identified some benefits for local communities at Toowong as a result of local road closures and turn bans. This included reductions in local traffic in some streets (i.e. Sylvan Road, Valentine Street, Quinn Street and Gregory Street) and subsequent improvements in local amenity and pedestrian and cycle access in these streets. The revised project will deliver benefits through reductions in traffic in local streets in the study corridor. However, the level of benefits for some streets may be reduced due to the removal of the road closures and turn bans in this area.

#### Impacts by Location – Kelvin Grove Connection

The removal of the Kelvin Grove connection will avoid the construction impacts for communities in the vicinity of Kelvin Grove Road, Lower Clifton Terrace, Upper Clifton Terrace and Victoria Street, outlined in Chapter 13 of the EIS for the EIS reference project.

In particular, the removal of the connection will avoid impacts on residential properties at Lower Clifton Terrace and at Westbury and Victoria streets, changes to local access and connectivity and impacts of construction works on local character and amenity.

Impacts of the EIS reference project on Marshall and MaCaskie parks at Kelvin Grove Road and some fig trees within the parks would also be avoided with the removal of the local connection to Kelvin Grove Road.

### Impacts on Private Property

The removal of the connections at Toowong and Kelvin Grove will reduce the number of properties impacted by surface works, either wholly or in part, from 116 properties to 13 properties. Properties affected by the revised project comprise a combination of State and Council owned land, including four properties at Kelvin Grove that comprise road reserve. A breakdown of the ownership and use of properties for the EIS reference project and revised project is provided in **Table 4-34**.

**Table 4-34 Comparison of Land Requirements for EIS Reference Project and the Project**

| | Toowong | | Kelvin Grove | | Total | |
|---|---|---|---|---|---|---|
| Ownership and Use | EIS | Project | EIS | Project | EIS | Project |
| State | 1 | 1 | 4 | 4 | 5 | 5 |
| Council | 7 | 4 | 8 | 4 | 15 | 8 |
| Private | 66 | - | 30 | - | 96 | - |
| **Total** | **74** | **5** | **42** | **8** | **116** | **13** |
| Commercial | 8 | | 3 | | 11 | |
| Residential | 57 | | 28 | | 85 | |
| Public land | 5 | 5 | 4 | 4 | 9 | 9 |
| Road | 4 | | 6 | 4 | 10 | 4 |
| Vacant | 0 | | 1 | | 1 | |
| **TOTAL** | **74** | **5** | **42** | **8** | **116** | **13** |

The removal of the connection ramps will provide some certainty for current and prospective property owners at Toowong and Kelvin Grove, which may redress the perceived negative impacts on property values as a result of the project. However, as described in Chapter 13 of the EIS, property values are supported by improved accessibility to cross city connections. As such, some of the benefits for property values at Toowong and Kelvin Grove that may have otherwise been experienced as a result of improved accessibility may be less.

### Community Health and Safety

The removal of the connections at Toowong and Kelvin Grove may assist in reducing possible project related stress and anxiety for some property owners, by providing certainty about the acquisition of surface properties. However, some residents above the tunnel alignment or near worksites at the Western Freeway may continue to experience a level of uncertainty, as described in Section 13.3.8 of the EIS.

### Impacts on Employment

The removal of the connection ramps will avoid direct impacts on local businesses at Toowong and Kelvin Grove and the need for some businesses to relocate for the project. This would avoid possible consequential impacts on local employment at these businesses identified in Chapter 13 of the EIS.

### Population Growth and Diversity

The revised project would not require the acquisition of residential properties. As such, potential impacts of property acquisition identified in the EIS on population growth and diversity would be avoided.

## 4.9.2 Environmental Management and Monitoring

The removal of the connections at Toowong and Kelvin Grove will avoid many of the impacts of construction and operation for neighbourhoods in the vicinity of:

- Milton Road, Croydon Street, Jephson Street and Sylvan Road at Toowong; and
- Kelvin Grove Road, Lower Clifton Terrace, Upper Clifton Terrace and Victoria Street at Kelvin Grove.

As such, many of the environmental management and monitoring measures identified in Chapter 13 specific to these areas, would not be required. This includes consultation with directly impacted social infrastructure (i.e. Toowong Baptist Church, Toowong Private Hospital and Silk Shed Studio Group). However, measures relevant to other areas directly affected by the project (i.e. connections to the Western Freeway and Inner City Bypass and the tunnel alignment) would still be required.

## 4.10 Urban Design and Visual Environment

Due to the removal of the local connections the Project will not affect areas of Toowong east of the cemetery or the Kelvin Grove precinct and the associated urban design goals and objectives for these locations are no longer relevant to the Project. The assessment of impacts and proposal of mitigation measures for the Project are now confined to the areas of the Western Freeway and ICB connections.

The series of views, integrated views and visual perceptions from vantage points in the vicinity of the Toowong and Kelvin Grove local connections are removed as the Project no longer impacts these areas.

## 4.11 Economic Environment

Supplementary cost benefit analysis (CBA) modelling, as presented in **Appendix E**, was undertaken for both the EIS Reference Project and for the Project based on the updated traffic modelling inputs. The results from the CBA for the Project scenarios with a risk adjusted (P50) CAPEX at a discount rate of 6% are shown in **Table 4-35**.

- **Table 4-35 Project scenarios P50 CBA findings (6 percent discount rate)**

| Output | EIS Reference Project | The Project |
|---|---|---|
| Present Value of Benefits (PVB) | $3,720.2 m | $3,260.8 m |
| Present Value of Costs (PVC) | $2,456.6 m | $1,514.6 m. |
| Net Present Value (NPV) | $1,263.5 m | $1,746.2 m |
| Benefit Cost Ratio (BCR) | **1.5** | **2.2** |

The value of discounted total future benefits is stronger for the EIS Reference Project, based largely on the importance of travel time savings and vehicle operating costs provided by the greater level of accessibility afforded by the fully connected project. Other measures of benefits, including environmental externalities, which may be greater for the Project without the local connections, are proportionally not a significant contributor to the modelled benefits. The value of discounted total future costs, however is significantly higher

for the EIS Reference Project corresponding to the greater capital investment and annual operating and maintenance costs over the 40 year assessment period.

On the basis of the assumptions that have been adopted, the CBA model returns a strong positive net present value (NPV)[9] for each scenario over the assessment life of the project and represents a strong economic justification for proceeding with the project. The NPV is however, greater for the Project, based on the higher costs associated with the EIS Reference Project, despite its also higher benefits. The BCR[10] is also greater for the Project.

The CBA results provide an acceptable economic justification to proceed with either project scenario. While both project scenarios provide acceptable investment options, the Project, without the local connections, would present a better economic return.

## 4.12 Cumulative Impacts

### 4.12.1 Interrelationships of Overall Impacts within the Project

The potential for cumulative impacts associated with the interaction between mitigation measures designed to mitigate individual impacts (such as noise barriers) having a cumulative impact on other aspects of the Project (such as urban design) have been largely avoided through the decision to remove the local connections at Toowong and Kelvin Grove Road.

The likely health impacts of the predicted increases in ground level concentrations of pollutants from the combined emissions of both Northern Link ventilation outlets with the southern outlet for Airport Link and the northern ventilation outlet for CLEM7 would be less than reported for the EIS Reference Project. The EIS Reference Project reported that the predicted increase in ground level concentrations of pollutants from the combined effects of these known ventilation outlet locations would not effectively be measurable.

### 4.12.2 Cumulative Construction Impacts

As stated in Section 4.1.12, the impact of the Project on local access, public transport and active transport would be limited to temporary realignments of traffic lanes at the Mount Coot-tha Roundabout and on the ICB. Existing lane capacities would be maintained during construction with minimal effect on other project construction activities utilising traffic routes through these areas. The proposed traffic management and staging arrangements for the Project are identified in the Project Design drawings in Volume 2 of the Supplementary Report (Drawings EIS-TM-01 Rev B to EIS-TM 08 Rev B).

The two proposed spoil haulage routes that have the potential to overlap with construction activities of other projects reported in the EIS were the haul route to the Port of Brisbane and the haul route to Swanbank. Removal of the Kelvin Grove Road connection and associated worksite and spoil requirements for the local ramps has significantly reduced the spoil haulage component of the Project to the Port of Brisbane. This would also reduce any potential for significant cumulative impact with other major projects in this area including Airport Link and the Northern Busway as well as the last stages of the Gateway Motorway Upgrade Project.

The removal of the Milton Road worksite removes the need to haul spoil between that worksite and the Western Freeway worksite via the Western Freeway and the Moggill Road ramps, estimated at 43 truck loads per day.

[9] The NPV is the value of the total benefits minus the value of the total costs over the assessment period (40 years).

The remaining soil haulage task from the construction of the Western Freeway surface road works, transition structures and cut and cover tunnels remains with the Project although slightly reduced from 60 loads per day to 58 loads per day due to the absence of the initial Milton Road worksite establishment. As reported in the EIS for the Reference Project, the haul route to Swanbank, used by 60 trucks per day would represent only 0.1% of traffic on this route, so cumulative effects with various stages of the Ipswich Motorway Upgrade would be minimal, and even less so with the effects from the Project without the local connections.

### Hale Street Link

The most significant local project to potentially aggravate the construction effects of Northern Link was reported in the EIS to be the Hale Street Link. With construction starting later than anticipated for the EIS Reference Project, the Hale Street Link would be completed by mid 2010 and in operation before commencement of the Project in late 2010, so removing any potential for cumulative impacts with the final stages of the Hale Street Link construction. The Project no longer requires the coordination of construction traffic between the two projects. A coordinated approach should however still be taken to the delivery of major transport projects within the western and inner western transport corridor of Brisbane.

### The Centenary Highway and Western Freeway Upgrade

As indicated in the EIS Reference Project, an upgrade of the Centenary Highway and Western Freeway from four to six lanes inclusive of a single T2 lane each way between Mt Coot-tha Road and (approximately) Warrender Street, Darra with no upgrading of the Centenary Bridge, has been assumed to be operational by 2016. DTMR has advised in submission to the EIS that there is no commitment to this project despite its identification in the SEQIPP. Should this upgrade of the Centenary Motorway eventuate, as reported in the EIS, it is likely that use of the Centenary Highway and the Western Freeway by the Northern Link Project construction haulage vehicles would be finished prior to the start of substantial construction activities on this project.

## 4.12.3 Assessment of Cumulative Impacts with WBTNI Options

An assessment of the cumulative effects of the Project in operation with the State Government's Western Brisbane Transport Network Investigation (WBTNI) is reported in Section 4.1.13 above.

Key findings for this cumulative effects assessment were:

- the average weekday traffic use of the Project volume would reduce by 12.6%, from 48,800 vehicles per day in 2026 to 42,600 vehicles per day. This diversion rate is similar to that forecast for the EIS Reference Project.
- Overall the predominant cross-city function provided by Northern Link between the west, east and north would be maintained.
- Key roads such as ICB, Gympie Road, and Gateway Motorway north are forecast to experience traffic reductions in the cumulative scenario and would be likely to benefit from congestion relief. Increased traffic volumes are forecast for the Western Freeway and Centenary Highway (in line with the capacity upgrades that would be implemented on these corridors to feed a combination of Northern Link and WBTNI project 3).

[10] The benefit cost ration (BCR) is equal to the discounted total benefits over the assessment period divided by the discounted total costs (i.e. CAPEX and OPEX). A higher BCR indicates that the project has greater economic merit. A ratio great than 1 indicates that the project is economically viable in the context of the CBA.

- Preliminary testing of cumulative effects indicates minimal change to the local streets and city distributors in this the Inner West with the combination of the Northern Link Project and the WBTNI projects.

# 5. Additional Information

In addition to each of the matters raised in the public and advisory agencies' submissions (refer to Appendices A and B of the Supplementary Report), the Coordinator-General has requested additional information to be included in the supplementary report as identified below.

- A new round of noise monitoring at each of the noise monitoring locations to confirm that noise monitoring results provided in the EIS (undertaken in November 2007) are reflective of current noise levels.
- A life cycle assessment (capital and operational) of air filtration (for total suspended particulates and total oxides of nitrogen) during operation of the project, in accordance with the relevant standard procedures.
- A quantification of the cumulative traffic impacts (traffic flow, speed, travel times, capacity, public transport etc) of the construction of other relevant major road projects currently with Northern Link, including any implications for the wider road network.
- An assessment of the impacts of spoil placement at the Port of Brisbane and development of mitigation and management measures to avoid or minimise any potential impacts.
- An identification of how safe crossings for pedestrian and cyclists of Milton Road (between Sylvan Road and Croydon Street) and Croydon Street (between Sylvan Road and Milton Road) can be included in the project design.
- An identification of potential impacts and proposed mitigation measures on affected businesses (including businesses that are affected but not compulsorily acquired) and undertake a qualitative and quantitative assessment of the predicted economic costs and benefits of the project on all such businesses (for example, any losses to businesses in the vicinity of construction sites that may be impacted due to changes in traffic during construction etc.).
- A quantification of the area of park and open space impacted for both the construction and operation phases of the project. This information us to be presented for each park/open space area impacted including, but not limited to, Brisbane Forest Park, Anzac Park, Mt Coot-tha Botanic Gardens, Quinn Park, Victoria Park and the Toowong Cemetery. The proposed mitigation measures, including detailed off-setting arrangements (including timing of provision, location and quantity) are also required.
- An identification and assessment of any new risks of significantly increased traffic on residential streets around congestion points ('rat-running') associated with both the construction and operation phases of the project and proposed mitigation measures.
- Details of how the principles of the *Crime Prevention through Environmental Design Guidelines* (CPTED) will be included in the implementation of mitigation measures for the project, particularly in the areas where the portals and local connections are located.
- An identification of additional measures that could further reduce and mitigate the impact of the local connections.

## 5.1 Further Noise Monitoring

The Coordinator-General has requested a new round of noise monitoring at each of the noise monitoring locations to confirm that noise monitoring results provided in the EIS (undertaken in November 2007) are reflective of current noise levels.

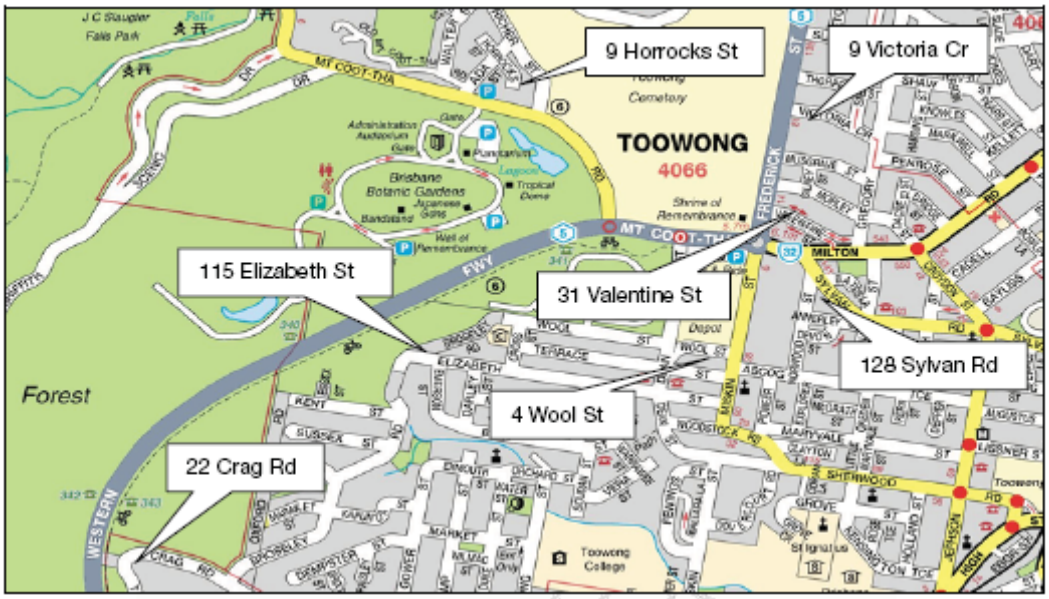
### 5.1.1 Monitoring Locations

The repeated baseline noise monitoring study was confined to the western end of the project to address specific concerns raised in submissions regarding heavy vehicle movements through the Toowong precinct during the

EIS noise monitoring. Attempts were made to replicate the EIS noise monitoring locations and methodology however at two locations this was not achievable due to denied access to private property. Subsequently, alternative locations with comparable site characteristics were chosen and are shown in **Figure 5-1**. The street addresses of the repeated baseline noise monitoring locations are:

- 22 Crag Road, Taringa;
- 9 Horrocks Street, Toowong;
- 9 Victoria Crescent, Toowong;
- 31 Valentine Street, Toowong (EIS site – 29 Valentine Street);
- 128 Sylvan Road, Toowong;
- 4 Wool Street, Toowong (EIS site – 6 Wool Street); and
- 115 Elizabeth Street, Toowong.

**Figure 5-1 Monitoring locations**




## 5.1.2 Methodology and Instrumentation

Noise monitoring was conducted in general accordance with Australian Standard AS1055-1997 *Acoustics – Description and Measurement of Environmental Noise* and the Queensland Environmental Protection Agency's *Noise Measurement Manual* (NMM) 2000.

For the unattended noise monitoring, the prevailing noise environment was measured in consecutive 15 minute periods for a minimum period of 7 days in accordance with the NMM.

The instrumentation that was used for the noise monitoring is listed in **Table 5-1**. The calibration of all instruments was checked before and after monitoring and the difference in noise level was within 1 dBA in all instances. All instruments were programmed to continuously record A-weighted fast response noise levels over 15 minute sampling intervals.

- **Table 5-1 Noise Monitoring Instrumentation**

| Location | Instrumentation |
|---|---|
| 1-7 | RION NC-73 Sound Level Calibrator, RION NA-27 Sound Level Meter |
| 1 | Acoustic Research Laboratories Environmental Noise Logger EL316, SN 16-301-471 |
| 2 | Acoustic Research Laboratories Environmental Noise Logger EL316, SN 16-299-426 and SN 16-203-524 |
| 3 | Acoustic Research Laboratories Environmental Noise Logger EL316, SN 16-203-524 |
| 4 | Acoustic Research Laboratories Environmental Noise Logger EL316, SN 16-203-529 |
| 5 | Acoustic Research Laboratories Environmental Noise Logger EL316, SN 16-203-525 |
| 6 | Acoustic Research Laboratories Environmental Noise Logger EL316, SN 16-203-505 |
| 7 | Acoustic Research Laboratories Environmental Noise Logger EL316, SN 16-203-508 |

### 5.1.3 Results

Monitoring sites were inspected during peak traffic times, the evening period and also during the late night/early morning period when background noise is typically quietest. The dominant audible sounds at each location are summarised in **Table 5-2**. As can be seen in **Table 5-2**, traffic noise from nearby major roadways was a dominant source of noise at all times of the day.

- **Table 5-2 Description of Existing Noise Environment**

| Location ID | Monitoring Location | Dominant Daytime & Evening Noise Sources | Dominant Noise Sources Late at Night |
|---|---|---|---|
| 1 | 22 Crag Road, Taringa | Western Freeway traffic | Western Freeway traffic |
| 2 | 9 Horrocks Street, Toowong | Mt Coot-tha Road traffic | Mt Coot-tha Road and occasional Freeway traffic |
| 3 | 9 Victoria Crescent, Toowong | Frederick Street traffic | Frederick Street traffic |
| 4 | 31 Valentine Street, Toowong | Milton Rd and Frederick Street traffic | Milton Rd and Frederick Street traffic |
| 5 | 128 Sylvan Road, Toowong | Milton Road and Sylvan Road traffic | Milton Road and Sylvan Road traffic |
| 6 | 4 Wool Street, Toowong | Western Freeway and Miskin Street traffic | Western Freeway and Miskin Street traffic |
| 7 | 115 Elizabeth Street, Toowong | Western Freeway traffic | Western Freeway traffic |

Unattended noise monitoring was undertaken between Friday 27 March and Thursday 9 April 2009, providing at least 7 days of continuous noise monitoring for each site. Equipment malfunction at 9 Horrocks Street resulted in additional monitoring at this site between Monday 27 April and Friday 1 May 2009. Weather conditions during the monitoring periods were typically fine and mild with some periods of rainfall. Winds were generally light to moderate, with typically calm conditions, or light winds, occurring at night.

The results of the repeated baseline monitoring, presented in **Table 5-3** ($L_{A10(18hour)}$) and Table 4 (Rating Background Levels), have been processed and are presented identically to the results presented in the EIS for direct comparison. The results in **Table 5-3** and **Table 5-4** exclude noise monitoring results obtained during periods of wind speeds in excess of 5 m/s as recommended in AS 1055.1 and/or rain periods greater than 0.5 mm per 15 minute interval.

## Table 5-3 Analysis of Baseline $L_{A10(18hour)}$ Noise Levels

| Monitoring Location | | Assessment of Average Day Evening Traffic Noise $L_{A10(18hour)}$ (dBA) | |
|---|---|---|---|
| | | EIS Result | Repeated 2009 Result |
| 1 | 22 Crag Road, Taringa | 59 | 58 |
| 2 | 9 Horrocks Street, Toowong | 58 | 58 |
| 3 | 9 Victoria Crescent, Toowong | 55 | 54 |
| 4 | 31 Valentine Street, Toowong | 59 (29 Valentine St) | 58 |
| 5 | 128 Sylvan Road, Toowong | 66 | 66 |
| 6 | 4 Wool Street, Toowong | 55 (6 Wool Street) | 54 |
| 7 | 115 Elizabeth Street, Toowong | 52 | 50 |

Note – $L_{A10(18hour)}$ refers to the time period between 6 am and 12 midnight.

## Table 5-4 Summary of (Unattended) Noise Logging Results

| Monitoring Location | | Rating Background Noise Levels min$L_{A90}$ (dBA) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Day 7am – 6pm | | Evening 6pm – 10pm | | Night 10pm – 7am | |
| | | EIS | Repeated | EIS | Repeated | EIS | Repeated |
| 1 | 22 Crag Road, Taringa | 48 | 48 | 46 | 45 | 39 | 38 |
| 2 | 9 Horrocks Street, Toowong | 51 | 51 | 48 | 48 | 37 | 36 |
| 3 | 9 Victoria Crescent, Toowong | 48 | 46 | 43 | 42 | 35 | 33 |
| 4 | 31 Valentine Street, Toowong | 53 | 53 | 50 | 50 | 43 | 42 |
| 5 | 128 Sylvan Road, Toowong | 49 | 49 | 44 | 45 | 35 | 35 |
| 6 | 4 Wool Street, Toowong | 47 | 46 | 41 | 42 | 37 | 38 |
| 7 | 115 Elizabeth Street, Toowong | 46 | 44 | 41 | 40 | 34 | 33 |

The operator-attended noise measurements are summarised in Table 5-5.

## Table 5-5 Summary of Operator-Attended (Short-term) Noise Measurements

| Monitoring Location | | Period | Date & Time | LA10 (dBA) | LAeq (dBA) | LA90 (dBA) | Discernible Sources |
|---|---|---|---|---|---|---|---|
| 1 | 22 Crag Road, Taringa | Day | 01/04/09 09:44 | 61 | 57 | 48 | Traffic on Crag Road and Western Freeway. Birds. |
| | | Evening | 31/03/09 19:11 | 59 | 56 | 49 | Traffic on Crag Road and Western Freeway. Insects. |
| | | Night | 01/04/09 00:12 | 45 | 43 | 38 | Traffic on Western Freeway. Insects. |
| 2 | 9 Horrocks Street, Toowong | Day | 01/04/09 10:13 | 60 | 57 | 52 | Traffic on Mt Coot-tha Road. Birds, aircraft. |
| | | Evening | 31/03/09 20:44 | 55 | 52 | 46 | Traffic on Mt Coot-tha Road. Insects. |
| | | Night | 31/03/09 22:45 | 53 | 50 | 41 | Traffic on Mt Coot-tha Road. Insects. Domestic. |
| 3 | 9 Victoria Crescent, | Day | 01/04/09 10:34 | 55 | 53 | 46 | Mostly birds. Traffic on Frederick St, aircraft. |

| Monitoring Location | | Period | Date & Time | LA10 (dBA) | LAeq (dBA) | LA90 (dBA) | Discernible Sources |
|---|---|---|---|---|---|---|---|
| | Toowong | Evening | 31/03/09 21:14 | 51 | 48 | 45 | Traffic on Frederick Street. Insects, wildlife. |
| | | Night | 31/03/09 23:14 | 49 | 40 | 41 | Traffic on Frederick Street and Victoria Crescent. Insects. |
| 4 | 31 Valentine Street, Toowong | Day | 31/03/09 16:25 | 60 | 58 | 54 | Milton Road, Frederick and Valentine Sts traffic. Workshop noise, birds. |
| | | Evening | 31/03/09 20:18 | 55 | 53 | 49 | Milton Rd and Frederick St traffic. Domestic. Insects. |
| | | Night | 31/03/09 22:17 | 54 | 52 | 48 | Milton Rd, Frederick and Valentine Sts traffic. Insects. |
| 5 | 128 Sylvan Road, Toowong | Day | 31/03/09 16:53 | 64 | 60 | 49 | Traffic on Sylvan and Milton Rds. Domestic. |
| | | Evening | 31/03/09 21:46 | 63 | 57 | 43 | Traffic on Sylvan Rd mostly, and Milton Rd. Insects. |
| | | Night | 31/03/09 01:43 | 46 | 48 | 36 | Milton and Sylvan Rds traffic. Train in background, wildlife, domestic. |
| 6 | 4 Wool Street, Toowong | Day | 31/03/09 17:14 | 52 | 53 | 46 | Miskin St, some Western Freeway/roundabout traffic. Birds, dog. |
| | | Evening | 31/03/09 19:58 | 51 | 56 | 42 | Western Freeway/ roundabout and Miskin St traffic. Insects, dog. |
| | | Night | 31/03/09 23:42 | 48 | 47 | 43 | Western Freeway/ roundabout and Miskin St traffic. Bus depot hum, insects, aircraft. |
| 7 | 115 Elizabeth Street, Toowong | Day | 31/03/09 17:41 | 52 | 50 | 47 | Western Freeway traffic. Birds, domestic noise. |
| | | Evening | 31/03/09 19:35 | 48 | 46 | 42 | Western Freeway traffic. Insects, domestic noise. |
| | | Night | 31/03/09 | 41 | 39 | 32 | Western Freeway traffic. Insects. |

### 5.1.4 Discussion

Comparison of the two data sets in **Table 5-3** and **Table 5-4** show a maximum variance of 2 dBA between the EIS monitoring and the repeated monitoring results. Regarding the $L_{A10(18hour)}$ parameter, all monitoring locations returned a lower result (average of 1 dBA and maximum difference of 2 dBA) with the exception of Sylvan Road and Horrocks Street which were the same as the EIS results.

Without significant change to the road network (eg surface type, signposted speed, barriers etc), the usual trend over time is for road traffic noise levels ($L_{A10(18hour))}$ to increase as a factor of traffic growth. Therefore, the resulting marginal reduction in road traffic noise level at some locations in the Toowong precinct may have resulted from a reduction in the number of heavy vehicle movements through the area during the 6 am and 12 midnight time period relevant to the $L_{A10(18hour)}$ parameter.

The recent decision to proceed with the Project without on and off ramps at Milton Road eliminates the need for noise barriers associated with these ramps.

## 5.2 Air filtration life cycle assessment

The Coordinator-General has requested a life cycle assessment (capital and operational) of air filtration (for total suspended particulates and total oxides of nitrogen) during operation of the project, in accordance with the relevant standard procedures.

The life cycle assessment (LCA) has been completed in accordance with AS 14040 *Environmental Management: Life cycle assessment – Principles and framework.* The goal is to quantify the major impacts and benefits of filtration systems for the Northern Link tunnel. The LCA examines the major impacts and benefits (including environmental externalities) of installing:

- a particulate filtration system – usually undertaken by electrostatic precipitation (ESP); and
- a nitrogen dioxide ($NO_2$) filtration system. –generally undertaken through a chemical absorption or adsorption process.

The function of these systems is the removal of air pollutants generated by motor vehicles within the tunnel and releasing the treated air to the atmosphere. In order to determine the environmental and economic performance of the system, the *functional unit* selected for the study is *tonnes of pollutants removed.* The particulate filtration system is assessed in terms of tonnes of $PM_{10}$ removed. The $PM_{10}$ component includes $PM_{2.5}$ and ultrafine particles ($PM_{0.1}$) The $NO_2$ filtration system is assessed in terms of tonnes $NO_2$ removed.

The system boundaries for this study include energy usage, emissions and financial expenditure associated with the construction and operation of the system, namely:

- capital expenditure;
- construction and operational energy use;
- greenhouse gas emissions; and
- downstream air quality emissions.

Quantitative estimates of pollutants removed, capital expenditure, energy usage, greenhouse gas emissions, and downstream air emissions are presented in the life cycle assessment of both filtration systems. Other inputs and emissions are discussed in a qualitative sense.

### 5.2.1 Life Cycle Inventory Analysis

#### Description of Life Cycle

*Construction Materials and Processes*

The proposed air filtration units would be constructed primarily from steel. The manufacture of steel requires energy, emits air pollutants, emits greenhouse gas emissions and produces waste slag.

The installation of the proposed air filtration units would require energy. Diesel is the most likely energy source for transportation of the proposed air filtration units and construction of the filtration station. The manufacture and combustion of diesel emits air pollutants, emits greenhouse gas emissions and produces wastewater.

*Operation and Maintenance Processes*

Electrostatic precipitators (ESPs) remove particulates (i.e.: suspended particles from the air) by applying an electric charge to them as they pass through an electric field and then collect them on a series of oppositely charged metallic plates. The plates are cleaned regularly either by a dry process (e.g.: shaking the plates) or by a wet process (e.g.: washing the plates). In both cleaning processes, the particles are collected and disposed of to

an appropriate site. The wet process requires an intermediate water filtration process to form a cake, while the water is either discharged or recycled.

$NO_2$ filtration is done through chemical reaction between the filter media and the $NO_2$ through either an absorption or adsorption process. Typically, an $NO_2$ filtration process requires prior particulate removal so it is often used in conjunction with a bank of ESPs. A separate plant (potentially off-site) would also be required to regenerate the filter $NO_2$ capture media. This plant would require additional make-up water, generate wastewater, and generate solid waste for disposal.

The operation of both the filtration systems would require electricity. Most electricity in South East Queensland is generated from coal-fired power plants. The mining of coal and combustion in coal-fired power plants emits air pollutants, emits greenhouse gas emissions and generates solid waste (flyash).

### *Decommissioning*

The decommissioning of the proposed air filtration units would generate waste steel. The waste steel may potentially be recycled. The decommissioning of these units would require energy and generate solid waste and potentially some wastewater. The transport of the solid waste/recycled material would generate air and greenhouse gas emissions.

## Data Collection

### *Capital Costs*

The estimation is based on information received from Mitsubishi Heavy Industries and Matsushita Ecology Systems Company in 2004 and has been escalated forward to 2009 through building cost escalation. As the main equipment is expected to be imported from Japan the equipment costs have also been increased in line with the movement of the Yen compared to Australian Dollar (AU$).

The capital expenditure for the ESP components of the particulate filtrations system is estimated to be A$41,500,000. This estimate is for the equipment only and does not include the associated building works. The filtration equipment would be installed adjacent to the two main vent stations. The building to house the filtration equipment would be approximately 25 m by 25 m by 20 m high.

The $NO_2$ filtration systems would require a particulate filtration system as a pre-filter. A separate plant (potentially off site) would also be required to regenerate the filter $NO_2$ capture media. The capital expenditure for the particulate filtrations system is presented in **Table 5-6**.

**Table 5-6 Total Capital Expenditure for $NO_2$ Filtration**

| Item | Cost |
|---|---|
| ESP | AU$41,500,000 |
| $NO_2$ Filtration components estimate | AU$129,100,000 |
| Regeneration Equipment | AU$6,400,000 |
| TOTAL | AU$177,000,000 |

This is the estimated cost for the equipment only and does not include the building works associated with these systems. The plant space required for the $NO_2$ filtration system is in the order of 250 $m^2$ face area at both the northern and southern ventilation stations. This represents a filtration chamber around 35 m wide, 7 m high and around 15 m long. Good maintenance access is also required to allow for the periodical replacement of the absorption media. This is in addition to the ESP space for the particulates filtration noted above.

### Energy usage

Based on operating the ESP system for 15 hours/day during 2014 and increasing to 17 hours/day in 2026 the electrical energy usage is estimated as follows:

- 2014: 2.1 GWh per annum (approx 1.5 GWh for additional pressure loss and 0.6 GWh for ESP power); and
- 2026: 2.2 GWh per annum (approx 1.5 GWh for additional pressure loss and 0.7 GWh for ESP power).

Based on operating the ESP/$NO_2$ filtration system for 15 hrs/day in 2014 and increasing to 17 hrs/day in 2026 the electrical energy usage is estimated as follows:

- 2014: 3.9 GWh per annum (approx 3.3 GWh for additional pressure loss and 0.6 GWh for ESP power); and
- 2026: 4.0 GWh per annum (approx 3.3 GWh for additional pressure loss and 0.7 GWh for ESP power).

Total energy use over 20 years has been determined by assuming the energy usage is at 2014 for the first 10 years of operation and at 2026 levels for the next 10 years of operation. The total energy usage over 20 years of operations is presented in **Table 5-7**.

**Table 5-7 Total energy usage over 20 year operation**

| Filtration System | Total Energy Usage |
|---|---|
| Particulate | 43 GWh |
| $NO_2$ | 79 GWh |

### Pollutant Removal

The hourly breakdown of emission rates of $NO_2$ and $PM_{10}$ is presented in **Table 5-8.**

The following assumptions were used in estimating tonnages of $PM_{10}$ and $NO_2$ removed over 20 years:

- 90% reduction in PM10 emissions can be achieved by ESP when operational;
- 90% reduction in NO2 emissions can be achieved by NO2 filtration when operational; and
- both filtration systems operate for 15 hours per day for 10 years and 17 hours per day for next 10 years of operations (non-operational hours shaded in **Table 5-8**).

- **Table 5-8 Emissions rates of $NO_2$ and $PM_{10}$ from Northern Link Ventilation Outlets in 2014 and 2026**

| | 2014 | | | | 2026 | | | |
|---|---|---|---|---|---|---|---|---|
| | Eastbound | | Westbound | | Eastbound | | Westbound | |
| Hour | $NO_2$ (g/s) | $PM_{10}$ (g/s) | $NO_2$ (g/s) | $PM_{10}$ (g/s) | $NO_2$ (g/s) | $PM_{10}$ (g/s) | $NO_2$ (g/s) | $PM_{10}$ (g/s) |
| 1 | 0.11 | 0.206 | 0.04 | 0.051 | 0.060 | 0.099 | 0.050 | 0.074 |
| 2 | 0.05 | 0.059 | 0.04 | 0.051 | 0.060 | 0.099 | 0.050 | 0.074 |
| 3 | 0.05 | 0.059 | 0.04 | 0.051 | 0.060 | 0.099 | 0.050 | 0.074 |
| 4 | 0.11 | 0.206 | 0.04 | 0.051 | 0.060 | 0.099 | 0.050 | 0.074 |
| 5 | 0.11 | 0.206 | 0.07 | 0.130 | 0.110 | 0.231 | 0.110 | 0.209 |
| 6 | 0.38 | 0.812 | 0.14 | 0.334 | 0.280 | 0.673 | 0.270 | 0.634 |
| 7 | 0.38 | 0.812 | 0.22 | 0.559 | 0.510 | 1.099 | 0.380 | 0.906 |
| 8 | 0.62 | 1.346 | 0.27 | 0.726 | 0.700 | 1.469 | 0.450 | 1.057 |
| 9 | 0.62 | 1.346 | 0.27 | 0.726 | 0.700 | 1.469 | 0.450 | 1.057 |
| 10 | 0.42 | 0.885 | 0.22 | 0.559 | 0.510 | 1.099 | 0.380 | 0.906 |
| 11 | 0.42 | 0.885 | 0.22 | 0.559 | 0.410 | 0.898 | 0.380 | 0.906 |
| 12 | 0.42 | 0.885 | 0.22 | 0.559 | 0.410 | 0.898 | 0.380 | 0.906 |
| 13 | 0.42 | 0.885 | 0.22 | 0.559 | 0.410 | 0.898 | 0.380 | 0.906 |
| 14 | 0.42 | 0.885 | 0.22 | 0.559 | 0.410 | 0.898 | 0.380 | 0.906 |
| 15 | 0.42 | 0.885 | 0.25 | 0.654 | 0.410 | 0.898 | 0.450 | 1.057 |
| 16 | 0.42 | 0.885 | 0.27 | 0.726 | 0.410 | 0.898 | 0.490 | 1.181 |
| 17 | 0.44 | 0.996 | 0.27 | 0.726 | 0.580 | 1.277 | 0.520 | 1.274 |
| 18 | 0.44 | 0.996 | 0.27 | 0.726 | 0.580 | 1.277 | 0.520 | 1.274 |
| 19 | 0.2 | 0.480 | 0.22 | 0.559 | 0.280 | 0.673 | 0.380 | 0.906 |
| 20 | 0.2 | 0.480 | 0.14 | 0.334 | 0.200 | 0.478 | 0.270 | 0.634 |
| 21 | 0.11 | 0.254 | 0.11 | 0.241 | 0.160 | 0.354 | 0.160 | 0.335 |
| 22 | 0.11 | 0.254 | 0.11 | 0.241 | 0.160 | 0.354 | 0.160 | 0.335 |
| 23 | 0.08 | 0.162 | 0.07 | 0.130 | 0.110 | 0.231 | 0.110 | 0.209 |
| 24 | 0.08 | 0.162 | 0.07 | 0.130 | 0.110 | 0.231 | 0.110 | 0.209 |

The total tonnages of $PM_{10}$ and $NO_2$ removed over 20 years of operation are presented in **Table 5-9.**

- **Table 5-9 Pollutants removed by filtration over 20 years of operation**

| Filtration System | Pollutant removed |
|---|---|
| Particulate | 15,074 t $PM_{10}$ |
| $NO_2$ | 6,573 t $NO_2$ |

## *Greenhouse Gas Emissions*

Greenhouse gas emissions have been estimated based on the assumed energy usage. The greenhouse gas emission factor for electricity end use in Queensland and greenhouse gas emission factor is 1.05 kg $CO_2$-e/kWh[11]. The greenhouse gas emissions from each filtration system over 20 years of operation are presented in **Table 5-10**.

[11] DCC, 2008, National Greenhouse Accounts (NGA) Factors, Department of Climate Change, Canberra, November 2008.

- **Table 5-10 Greenhouse gas emissions from filtration over 20 years of operation**

| Filtration System | Greenhouse Gas Emissions |
|---|---|
| Particulate | 45,150 t $CO_2$-e |
| $NO_2$ | 82,950 t $CO_2$-e |

## *Downstream Air Emissions*

The downstream air emissions of each filtration system were estimated based on energy usage determined above. It was assumed electricity was generated from coal-fired power station with 40% thermal efficiency. Air emission factors for oxides of nitrogen, $PM_{10}$ and $SO_2$ are presented in **Table 5-11**.

- **Table 5-11 Emission Factors for air emissions from coal-fired powered generation**

| Pollutant | Emission Factor | Notes |
|---|---|---|
| $NO_X$ | 6.0 kg / t coal | |
| $PM_{10}$ | 0.34 kg / t coal | Assumed with a fabric filter |
| $SO_2$ | 7.88 kg / t coal | Assumed sulphur content of 0.45 |

(source: NPI 2008[12])

The downstream air emissions for both filtration systems over 20 years of operation are presented in **Table 5-12**.

- **Table 5-12 Downstream air emissions from coal-fired powered generation over 20 years of operation**

| Pollutant | Particulate Filtration | $NO_2$ Filtration |
|---|---|---|
| $NO_X$ | 91.0 t | 167.1 t |
| $PM_{10}$ | 5.6 t | 10.3 t |
| $SO_2$ | 141.4 t | 259.8 t |

## *Operating Costs*

- Particulate Filtration

The largest operating cost associated with the particulate filtration system would be the cost of electricity. Other operating costs associated with the particulate filtration system would include:

- wastewater disposal;
- the supply of make-up water;
- disposal of solid waste; and
- periodic inspection / maintenance (monthly and annual checks).

- Nitrogen Dioxide Filtration

The largest operating cost associated with the nitrogen dioxide filtration system would be the cost of electricity. Other operating costs associated with the particulate filtration system would include:

- transportation of media (between 6 to 12 months);

[12] NPI, 2005, Emission Estimation Technique Manual for Fossil Fuel Electric Power Generation v2.4, March 2005.

- wastewater disposal;
- the supply of make-up water;
- disposal of solid waste ; and
- periodic inspection / maintenance (monthly and annual checks).

### 5.2.2 Life Cycle Impact Assessment

#### Particulate Filtration

The life cycle assessment for a particulate filtration system is presented in **Table 5-13.** **Table 5-13** presents the capital cost, energy usage, greenhouse gas emissions and downstream air emission in terms of tonnes of $PM_{10}$ removed.

- **Table 5-13 Life cycle assessment of particulate filtration**

| Stage | Description | Value (per t of filtered $PM_{10}$) | Comment |
|---|---|---|---|
| Construction | Capital Cost | $2,750 | |
| | Material Inputs | | Steel used for manufacture |
| | Energy Usage | | As part of mining/manufacturing process and construction |
| | GHG emissions | | Some from mining/manufacturing process and construction |
| | Air emissions | | Some from mining/manufacturing process and construction |
| | Wastewater | | Some from mining/manufacturing process |
| | Solid waste | | Waste slag from smelting |
| Operation | Energy Usage | 2,853 kWh | |
| | Water Usage | | Small quantities may be required if wet cleaning |
| | Operating Cost | | Major cost is electricity, |
| | GHG Emissions | 3.0 t $CO_2$-e | |
| | Wastewater | | Potential if wet cleaning |
| | Solid waste | | Collected particulate matter or filtrate |
| | Downstream air emissions: | | |
| | ▪ $NO_X$ | 6.0 kg | |
| | ▪ $PM_{10}$ | 0.4 kg | |
| | ▪ $SO_2$ | 9.4 kg | |
| Decommissioning | Solid Waste | | Yes - not quantified |
| | GHG Emissions | | Transport/recycling of scrap metal |
| | Air emissions | | Transport |

A particulate filtration system for the Northern Link tunnel would incur capital costs of $2,750 per tonne of $PM_{10}$ removed over 20 years of operation. The operation of a particulate filtration system would also generate greenhouse gas emissions of 3.0 t $CO_2$-e per tonne of $PM_{10}$ removed.

#### Nitrogen Dioxide Filtration

The life cycle assessment for a $NO_2$ filtration system is presented in **Table 5-14**. **Table 5-14** presents the capital cost, energy usage, greenhouse gas emissions and downstream air emission in terms of tonnes of $NO_2$ removed.

- **Table 5-14 Life cycle assessment of $NO_2$ filtration**

| Stage | Description | Value (per t of filtered $NO_2$) | Comment |
|---|---|---|---|
| Construction | Capital Cost | $27,000 | |
| | Material Inputs | | Steel used for manufacture |
| | Energy Usage | | As part of mining/manufacturing process and construction |
| | GHG emissions | | Some from mining/manufacturing process and construction |
| | Air emissions | | Some from mining/manufacturing process and construction |
| | Wastewater | | Some from mining/manufacturing process |
| | Solid waste | | Waste slag from smelting |
| Operation | Energy Usage | 12,018 kWh | |
| | Water Usage | | Required for regeneration plant |
| | Operating Cost | | Major cost is electricity |
| | GHG Emissions | 12.6 t $CO_2$-e | |
| | Wastewater | | From regeneration plant |
| | Solid waste | | From regeneration plant |
| | Downstream air emissions: | | |
| | ▪ $NO_X$ | 25.4 kg | |
| | ▪ $PM_{10}$ | 1.6 kg | |
| | ▪ $SO_2$ | 39.5 kg | |
| Decommissioning | Solid Waste | | Yes - not quantified |
| | GHG Emissions | | Transport/recycling of scrap metal |
| | Air emissions | | Transport |

A $NO_2$ filtration system for the Northern Link tunnel would incur capital costs of $27,000 per tonne of $NO_2$ removed over 20 years of operation. The operation of a $NO_2$ filtration system would also generate greenhouse gas emissions of 12.6 t $CO_2$-e per tonne of $NO_2$ removed.

## 5.3 Cumulative construction traffic impacts

The Coordinator-General has requested a quantification of the cumulative traffic impacts (traffic flow, speed, travel times, capacity, public transport etc) of the construction of other relevant major road projects concurrently with Northern Link, including any implications for the wider road network.

The impact of the Project during construction on local access, public transport and active transport would be limited to temporary realignments of traffic lanes at the Mount Coot-tha Roundabout and on the ICB. Existing lane capacities would be maintained during construction with minimal effect on other project construction activities utilising traffic routes through these areas. Public and active transport routes would be maintained during construction, although there would be temporary realignments and repositioning of connections, including bus stops to meet the requirements of Translink and Council. The proposed traffic management and staging arrangements for the Project are identified in the Project Design drawings in Volume 2 of the Supplementary Report (Drawings EIS-TM-01 Rev B to EIS-TM 08 Rev B).

The two proposed spoil haulage routes that have the potential to overlap with construction activities of other projects reported in the EIS were the haul route to the Port of Brisbane and the haul route to Swanbank.

Removal of the Kelvin Grove Road connection and associated worksite and spoil requirements for the local ramps has significantly reduced the spoil haulage component of the Project to the Port of Brisbane. This would also reduce any potential for significant cumulative impact with other major projects in this area including Airport Link and the Northern Busway as well as the last stages of the Gateway Motorway Upgrade Project.

The removal of the Milton Road worksite removes the need to haul spoil between that worksite and the Western Freeway worksite via the Western Freeway and the Moggill Road ramps, estimated at 43 truck loads per day. The remaining soil haulage task from the construction of the Western Freeway surface road works, transition structures and cut and cover tunnels remains with the Project although slightly reduced from 60 loads per day to 58 loads per day due to the absence of the initial Milton Road worksite establishment. As reported in the EIS for the Reference Project, the haul route to Swanbank, used by 60 trucks per day would represent only 0.1% of traffic on this route, so cumulative effects with various stages of the Ipswich Motorway Upgrade would be minimal, and even less so with the effects from the Project without the local connections.

### Hale Street Link

The most significant local project to potentially aggravate the construction effects of Northern Link was reported in the EIS to be the Hale Street Link. With construction of the Project starting later than anticipated for the EIS Reference Project, the Hale Street Link would be completed by mid 2010 and in operation before the anticipated commencement of the Project in late 2010, so removing any potential for cumulative impacts with the final stages of the Hale Street Link construction. The Project no longer requires the coordination of construction traffic between the two projects.

### The Centenary Highway and Western Freeway Upgrade

As indicated in the EIS Reference Project, an upgrade of the Centenary Highway and Western Freeway from four to six lanes inclusive of a single T2 lane each way between Mt Coot-tha Road and (approximately) Warrender Street, Darra with no upgrading of the Centenary Bridge, has been assumed to be operational by 2016. DTMR has advised in submission to the EIS that there is no commitment to this project despite its identification in the SEQIPP. Should this upgrade of the Centenary Motorway eventuate, as reported in the EIS, it is likely that use of the Centenary Highway and the Western Freeway by the Northern Link Project construction haulage vehicles would be finished prior to the start of substantial construction activities on this project.

If the upgrading of the Centenary Motorway were to proceed within an earlier time-frame, and there was an overlap between Northern Link haulage truck use and construction activities associated with upgrading of the Centenary Highway and/or Western Freeway, it would be anticipated that the corridor would continue to remain fully operational. As the number of road haulage vehicles generated by the Project construction activities is small, i.e. 58 truck movements per day in each direction to Swanbank, it would be anticipated that these would remain an allowable use within the corridor due to their minor contribution to overall traffic volumes. A coordinated approach should however still be taken to the delivery of major transport projects within the western and inner western transport corridors of Brisbane.

## 5.4 Spoil placement at the Port of Brisbane

The Coordinator-General has requested an assessment of the impacts of spoil placement at the Port of Brisbane and development of mitigation and management measures to avoid or minimise any potential impacts. As stated in Chapter 4 of the EIS, all of the spoil from the eastern/northern end of the Project would be taken to the Port of Brisbane placement site at Fisherman Islands and/or the Port West Estate. This included spoil from the proposed Kelvin Grove Road worksite which would produce approximately 300,00m$^3$ of spoil from the

construction of the tunnel ramps at a continuous rate of approximately 49 loaded trucks a day. Without the Kelvin Grove Road connection, spoil movements from the ICB connection is forecast to produce 25,000m$^3$ of spoil with an associated approximate intensity of 3 loaded truck movements per day to the Port of Brisbane placement sites.

The Fisherman Islands Precinct and the Port West Estate fall under the control of the Port of Brisbane Corporation. The Port of Brisbane Corporation is the regulatory authority for development on Strategic Port Land. The Port of Brisbane Corporation Development Guidelines for Strategic Port Land specifically identifies criteria against which development is to be assessed. In particular, it is stated that development must be located and undertaken in a manner that does not impact on areas of high ecological value identified on the Land Use Strategy Map and other areas designated as having high environmental value.

The Fisherman Islands Precinct is part of the approved reclamation of around 230ha within the constructed seawall that has been extended by some 1,800m. Filling of the interior is being completed in discrete components over the next 10-15 years. The reclamation area is undergoing gradual filling primarily from dredge spoil and preparation for development. It can take 6 years from the time of placing the first dredge spoil to the time when a 20 hectare paddock is ready for development.

The Fisherman Islands reclamation area was referred by the Port of Brisbane Corporation to the Commonwealth Government under the EPBC Act in 2000 and was declared a controlled action. A decision to approve the reclamation of 230ha for additional port land by way of an extension 1800m northward of existing reclamation at Fisherman Islands including filling of the area using dredge spoil was issued by the then Minister for the Environment and Heritage in 2001, with effect until 2029. The conditions were focussed on managing the impacts of construction of the bund wall and reclamation works on migratory species and the impacts of turbidity plumes associated with construction of the bund wall on the ecological character of the Ramsar wetland. A Shorebird Management Plan was approved by DEH in March 2002 and an EMP for the Bund construction was approved by the Qld EPA in July 2002 and subsequently accepted as the required document for meeting the conditions of approval by the DEH. The bund wall has been completed and land within the bund wall is being reclaimed in accordance with a Section 91 approval under the then *Harbours Act 1955* (Qld) issued on 30 August 2002 by the Queensland EPA. The EPA approval to reclaim the identified land is subject to appropriate conditions including for the acceptance and placement of fill[13].

The Port West Estate is within the Lytton Precinct south of the Brisbane River, under the control of the Port of Brisbane Corporation. The site is one of the largest areas of vacant riverside land available within the Port of Brisbane. The site is approximately 100ha in size and fill requirements are estimated to be 2M m$^3$. The land is identified in the Australia TradeCoast Local Plan as suitable for heavy industry given its separation from residential areas. The site is identified on the land use strategy map for the Port of Brisbane as not being an area of high ecological value. The lands are clear of remnant native vegetation and have been identified in the land use strategy to accommodate maritime industries and/or port operational activities requiring direct river frontage.

Regardless of the spoil site location, if spoil material is found during tunnelling operations to be contaminated, the movement and disposal of the material will be subject to permit requirements under the *Environmental Protection Act 1994* (Qld).

[13] Refer to "Authority to Reclaim Land" lying below high water mark as shown on plan H-520, subject to the terms and conditions set out in the Authority as issued to Port of Brisbane Corporation, by the EPA, 30 August 2002.

The final placement of spoil within the Port of Brisbane lands would depend on a range of pre-established conditions including the availability of the land area at the time of tunnel construction, the prior approval of the use of that land for its intended purpose that necessitates filling, any operational approvals and environmental licences or authorities required by the haulage contractor, and the approval of the Port of Brisbane Corporation, including the acceptability of any commercial arrangements entered into for the acceptance of the filling material.

The acceptance of fill, the method of placement and the environmental management and mitigation requirements would be subject to the approval of the Port of Brisbane Corporation that such fill meets both engineering and environmental requirements as defined by their statutory approvals to undertake such a land use. The placement of fill will only occur in or on an approved development or facility, subject to any applicable conditions.

## 5.5 Crossings for pedestrian and cyclists of Milton Road

The Coordinator-General has requested an identification of how safe crossings for pedestrian and cyclists of Milton Road (between Sylvan Road and Croydon Street) and Croydon Street (between Sylvan Road and Milton Road) can be included in the project design.

An investigation of safe crossings for pedestrian and cyclists of Milton Road (between Sylvan Road and Croydon Street) was undertaken and reported in Chapter 3 of the EIS during the development of the Reference Project. The crossing options investigated included:

- at-grade signalised pedestrian crossing of Milton Road between Croydon Street and Frederick Street connecting to Quinn Park on the southern side;
- pedestrian underpass of Milton Road from the vicinity of Valentine Street and Gregory Street on the northern side connecting to Quinn Park on the southern side;
- pedestrian overpass of Milton Road from the vicinity of Valentine Street and Gregory Street on the northern side connecting to Quinn Park on the southern side; and
- pedestrian overpass at the western leg of Milton Road to replace the removed at-grade pedestrian crossing.

The investigation concluded that:

- The signalised pedestrian crossing would require the lowest capital cost to implement. However, the crossing could have a negative impact on the road network performance and would have sight distance constraints for the westbound crossing of Milton Road due to the walled structures connecting to the elevated tunnel ramps.
- The pedestrian underpass would require a high capital cost, maintenance costs such as cleaning, lighting and surveillance costs, and would likely be subject to vandalism with risk to personal security.
- The pedestrian overpass from the vicinity of Valentine Street and Gregory Street would require high capital cost, maintenance costs and safety concerns particularly at night. The overpass would have visual impacts and depending on the design of the southern ramp approach require more land in Quinn Park.
- The pedestrian overpass at the western leg of Milton Road to replace the removed pedestrian crossing would, in addition to the impacts described above, further impact residential access to Morley Street resulting from the northern approach ramps.

It was concluded that whilst the options provided some benefit of additional connectivity to and from the northern side of Milton Road, these options would not be feasible.

Safe crossings of Croydon Street, between Milton Road and Sylvan Road, would have been provided via signalised crossings alongside the intersection with Milton Road and also alongside the intersection with Sylvan Road. Safety on Croydon Street, between Milton Road and Sylvan Road, would have also been increased with the EIS Reference Project, including through the provision of off-road bicycle facilities in conjunction with urban design measures, and signalised bicycle crossing at the Croydon Street Sylvan Road intersection.

As a consequence of removing the Toowong connection ramps, no changes are proposed to the current configuration of Milton Road and its intersection with Croydon Street. Pedestrians and cyclists will be able to cross Milton Road and Croydon Street under the existing arrangements provided.

## 5.6 Business impact assessment

The Coordinator-General has requested an identification of potential impacts and proposed mitigation measures on affected businesses (including businesses that are affected but not compulsorily acquired). The request included undertaking a qualitative and quantitative assessment of the predicted economic costs and benefits of the project on all such businesses (for example, any losses to businesses in the vicinity of construction sites that may be impacted due to changes in traffic during construction etc.).

Since the Coordinator-General's request for information about the potential impacts on businesses, the Council decided to remove the local connections at Toowong and at Kelvin Grove. Consequently, many of the potential impacts on local businesses that would have arisen with implementation of the EIS reference project, would be avoided with implementation of the Project without local connections. A comparison of the numbers of commercial properties potentially impacted by the EIS Reference Project and the Project without local connections is presented in **Table 5-15**.

- **Table 5-15: Comparison – Potentially-impacted Commercial Properties**

| Connections | EIS Reference Project | Project (without local connections) |
|---|---|---|
| West (Mt Coot-tha – Toowong) | 31 | 3 |
| East (Kelvin Grove, Herston) | 11 | 1 |

**Table Note:** Potentially impacted properties in Mt Coot-tha, Toowong and Kelvin Grove include a number of multiple tenancies (eg shopping centres)

In general, commercial properties would have been affected through changes to access to parking or through changes to street access. For some commercial properties, the impact would have been through a change to their visibility or 'exposure' to a thoroughfare. Predicted changes in traffic flows past a commercial property are not considered as impacts unless physical changes to the street are required to accommodate such flows, and where those changes impact on the property.

No commercial properties would be acquired for the Project; only a small number of commercial properties would have been acquired for the EIS Reference Project. However, the Botanical Gardens and Victoria Park Golf Complex would be affected by partial acquisitions of land.

### 5.6.1 Businesses adjacent to Western Connection and Toowong Connection

For the EIS reference project, the impact on commercial properties would have been greatest in the vicinity of the Toowong local connection on Milton Road. A number of commercial properties would have been acquired to accommodate the proposed widening of Milton Road and the ramps. Those properties would include:

- the Mitsubishi car dealership;

- the Caltex service station; and
- the Milton tennis centre.

Other commercial properties on Milton Road that would have been influenced by the local connection but not have any land required for the Project, include:

- the Subaru car dealership;
- a building contractor's offices;
- a car wash; and
- a commercial office.

These potential impacts would not arise with the Project without the Toowong local connection.

The Project would not permanently require any land from the Mt Coot-tha Botanic Gardens site defined by its security fence. During construction a corridor of land would be required through the botanic gardens for the spoil conveyor route. The Project would require an area of the Landscape Amenity Parkland between the botanic gardens and the Western Freeway for the construction worksite and ultimately, a smaller area for the construction of the ventilation station and north-bound carriageway to the tunnel.

The Mt Coot-tha Botanic Gardens are owned and operated by the Council. There are a number of businesses and government entities situated within the Mt Coot-tha Botanic Gardens, including:

- botanic gardens – abutting the Project;
- the Planetarium – > 215m from the Project;
- Queensland Herbarium – > 250m from the Project;
- Lakeside Gardens restaurant and kiosk – >165m from the Project, with the restaurant lake and associated wedding area some 180m distant; and
- Council library – > 300m from the Project.

Each of these provides employment as follows:

- 55 full-time staff plus 100 volunteers in the Botanic Gardens;
- 9 full time staff in the Planetarium;
- 60 fulltime staff in the Queensland Herbarium; and
- 16 staff in the Gardens Lakeside Restaurant.

The potential impacts of the Project on the Mt Coot-tha Botanic Gardens include:

- construction and establishment of the construction worksite on land beside the Mt Coot-tha Botanic Gardens;
- construction of spoil handling facilities, namely the acoustically insulated shed on the western worksite and the conveyor from the worksite across the Mt Coot-tha Botanic Gardens site to Mt Coot-tha Quarry;
- construction impacts (eg potential for impacts on noise, air quality, heavy vehicle movements, vegetation loss,);
- the construction and subsequent operation of the western ventilation station, including ancillary buildings such as an electricity sub-station; and
- location of the Tunnel Control Centre on the rehabilitated western worksite.

None of these impacts would be likely to lead to a reduction in employment within the Mt Coot-tha Botanic Gardens, or the associated businesses operating there. With effective mitigation of the environmental effects of

construction within the western worksite, the visitor experience at the Mt Coot-tha Botanic Gardens could still be expected to change, with some activities being relocated to other locations within the facility (eg wedding parties, fairs, displays). Indoor activities are not expected to be affected.

The Mt Coot-tha Quarry is owned and operated by the Brisbane City Council. Access to the quarry is gained from Mt Coot-tha Road, outbound from the Mt Coot-tha Botanic Gardens. The quarry produces approximately 410,000 tonnes per annum of range of high-quality aggregates for both concreting and asphalting purposes for Council's on-going road construction and maintenance program. Aggregates are used at the Council's asphalt plant at Eagle Farm, approximately 13km to the east. The quarry employs 20 full-time staff.

The potential impacts of Northern Link on the Mt Coot-tha Quarry would arise during the construction phase as spoil from tunnel construction is received, via conveyor, for handling and storage. Construction-phase impacts would be of an operational nature and would be the concern of the owner and operator, the Brisbane City Council. The use of the quarry for receiving, handling and storing of spoil from the project works would remain consistent and in accordance with existing approvals and licences.

Businesses situated on Sir Samuel Griffith Drive, Mt Coot-tha, include The Summit Restaurant and four television stations which include broadcasting and production facilities and activities. During preliminary consultation with the television station managers, conducted during the preparation of the EIS, it was indicated that access to each facility would be maintained during the construction phase. Similarly, access to The Summit restaurant would be maintained throughout.

### 5.6.2 Businesses adjacent to Kelvin Grove Connection and Herston Connection

The Project without the Kelvin Grove connection would have no impact on access to or exposure of any businesses on Kelvin Grove Road. The Project would not require any land in this corridor.

The delivery and implementation of the EIS reference project with the Kelvin Grove connection, would have potentially impacted on businesses fronting Kelvin Grove Road south of Blamey Street and north of the Normanby Fiveways, which include:

- the Normanby Hotel;
- Sunny Queen Eggs site now occupied by the Horizon Alliance project office;
- Ensign Distribution; and
- several small businesses including Fuch's garage, Miss India takeaway.

These businesses rely upon a combination of passing trade and local support. Access to each of them is influenced and constrained by the street pattern, land use pattern and traffic flows. Construction of the EIS reference project would have affected access to and exposure of these businesses during the construction period.

The Kelvin Grove Urban Village (> 400m) and the Hilltop Gardens retirement village (>360m) situated in Rochester Terrace would be able to continue normal operations in terms of access and connectivity to essential services during construction of the Project. The same outcome is expected for other community activities such as the Brisbane Grammar School playing fields with access to Victoria Park Road.

The Victoria Park golf complex would be impacted by the Project with surface property impacts along the Inner City Bypass to accommodate the ventilation station and ventilation outlet and for road widening. The structured facilities of the golf course are all greater than 500m from the ventilation station and nearby ventilation outlet.

### 5.6.3 Summary of Business Impacts

The extent of potential impacts on businesses and commercial properties likely to arise from the EIS Reference Project would be greatly reduced by construction of the Project without local connections. In particular, the local businesses situated in the precincts of Milton Road and Kelvin Grove Road would be unaffected by the Project without local connections. The businesses and Government entities upon which there is some potential for impact with delivery and implementation of the Project without the local connections, are situated mostly on State or Council land, and are mostly Council-operated. The EIS proposes a comprehensive approach to impact management during construction to avoid potential impacts on the Mt Coot-tha Botanic Gardens and the businesses situated therein.

There is a mitigation and management strategy for any potential impacts on the operation of the Mt Coot-tha Quarry during construction. This is a Council business. Council has identified alternative sources of quarry materials to meet demand during construction should that become necessary. Council has also made provision for the possible re-use of construction spoil to meet part of its demands for quarry products.

Property impacts for the ICB connection would accrue on the southern boundary of Victoria Park golf complex. There would be no direct impact on the businesses operating from within the golf complex, such as the catering and restaurant business or the driving range or golf shop.

## 5.7 Park and open space impacts

The Coordinator-General has requested a quantification of the area of park and open space impacted for both the construction and operation phases of the project. This information is to be presented for each park/open space area impacted including, but not limited to, Brisbane Forest Park, Anzac Park, Mt Coot-tha Botanic Gardens, Quinn Park, Victoria Park and the Toowong Cemetery. The proposed mitigation measures, including detailed off-setting arrangements (including timing of provision, location and quantity) are also required.

The Project without local connections, as now proposed, has greatly reduced impact on open space areas because impacts on Quinn Park in Toowong and Marshall and McCaskie Parks in Kelvin Grove are eliminated. The remaining impacts are all within or closely adjacent to existing road reserves for the Western Freeway and ICB.

The western worksite is an area of approximately 3.2ha that lies between the boundary fence of the Mt Coot-tha Botanic Gardens and the proposed transition structure to access the tunnel eastbound. This area is rarely used for recreation purposes because of access difficulties but rather finds a use as adjunct storage space for the botanic gardens. Apart from the area required for the ventilation station and its access the area would not be required beyond construction and as noted in the EIS would be rehabilitated and landscaped in line with the botanic gardens masterplan as soon as possible after construction.

All of the land required for Northern Link along the Western Freeway is road verge that has been disturbed in the past, mostly during construction of the Western Freeway in the late 1970s and is covered with regrowth vegetation. This land has minimal recreational value except to accommodate the bikeway that will be relocated during construction and reinstated after construction.

Of these areas the conveyor corridor would be required for the construction period only as would the western worksite except for the area within it required for the ventilation station and access to the station.

In Victoria Park approximately one tenth of a hectare would be required for the ventilation station and outlet footprints and a similar very narrow area along the ICB boundary for minimal road widening. The air ducts from the tunnel to the vent station and on to the vent outlet would be sunk into the ground so the land would be

required during construction but upon completion the duct would be covered with soil and the area landscaped back to resemble its present environment.

**Table 5-16** and **Table 5-17** show the surface land requirements of Northern Link during construction and operation, respectively.

The mitigation measures proposed for the Western Connection are defined in the EIS (Volume 1, Chapter 14, Section 14.7.1) where off setting proposals are offered in the form of revegetation, rehabilitation and enhancement of the following areas disturbed during construction:

- the conveyor corridor through the botanic gardens;
- cuttings along both sides of the Western Freeway;
- gateway to the botanic gardens and Mt Coot-tha;
- new planting and rehabilitation of Western worksite; and
- the waterway through the botanic gardens including the storage dam proposed by the botanic gardens and Anzac Park.

Figure 14-10 in the EIS shows the masterplan for the area of the western worksite and the Western Freeway with various mitigation measures that would be provided immediately on completion of construction.

For Victoria Park mitigation measures are outlined in the EIS (Volume 1, Chapter 14, Section 14.7.3) and illustrated on Figure 14-12 of the EIS. Significant replantings to create an urban forest environment are proposed along the margin with the ICB immediately upon completion of construction.

- **Table 5-16 Open Space impacted during Construction**

| Park | Existing area ($m^2$) | Project Need ($m^2$) | Comment | Offset/Mitigation | Timing |
|---|---|---|---|---|---|
| Brisbane Forest Park | >285,000,000 | 3360 | Southeast side of Western Freeway for westbound 2 lane transition structure and lane merge construction. | Revegetate cuttings and medians with sightline considerations in accordance with landscape design. | Post construction, landscape design treatments. |
| Landscape Amenity Park on Western Freeway | 32000 | 32000 | Area for western worksite and ventilation station. | Provision of earth mounding, regrading and turfing of worksite in accordance with Botanic Gardens expansion plan. | Post construction landscape design treatments in consultation with Council and Botanic Gardens master plan. |
| Anzac Park | 141,000 | 5000 | Southeast side of Western freeway for westbound cut and cover tunnel, transition structure and pedestrian and cycle construction. | Revegetate, rehabilitate and enhance disturbed areas including urban forest treatments to tunnel cover, the waterway running alongside Anzac Park and any recreation areas and connections for pedestrians and cyclists. | Post construction landscape design treatments. |
| Mt Coot-tha Botanic Gardens | 390,000 | 3600 | For approximately 360m of its length the conveyor route would require a corridor, nominally 10m wide, through part of the botanic gardens. | Revegetation and restoration to prior use in accordance with the requirements of the Botanic Gardens. | Immediately following required use of the external spoil conveyor in consultation with Botanic Gardens. |
| Victoria Park | 595,000 | 3500 (=1000 along ICB +1000 for Ventilation station + 1500 for connecting ducts) | Alongside ICB for eastbound exit lanes from tunnel– does not encroach on foot/bike path or land bridge<br>The footprint of the ventilation station, ventilation and connecting ducts underground. | Rehabilitation and revegetation of areas cleared for construction, including drainage channel flowing into York's Hollow beside the ICB. Provision of excavated ground tree stock (>4m high) for urban forest to new open space created by eastbound tunnel portal. Make good and enhance all existing pedestrian and cycle connections. Provision of significant tree plantings to ventilation station design. | Post construction landscape design treatments. |
| Toowong Cemetery | 435,000 | 0 | No effect | | |

- **Table 5-17 Open Space impacted during Operation**

| Park | Existing area ($m^2$) | Project Need ($m^2$) | Comment | Offset / Mitigation | Timing |
|---|---|---|---|---|---|
| Brisbane Forest Park | >285,000,000 | 3360 (0.00118 %) | Along southeast side of Western Freeway for westbound tunnel portal transition structure and 2 lane merge. | No off set proposed – formally a section of Western Freeway Road Reserve. | Tunnel Operation |
| Landscape Amenity Park on Western Freeway | 32,000 | 2000 (6%) | Ventilation station. | Provision of 18ML water storage dam for use by the Botanic Gardens. | Post construction. |
| Anzac Park | 141,000 | 5000 (3.5%) | Southeast side of Western freeway alignment for westbound tunnel transition structure, bikeway corridor and associated southern connection to pedestrian and bikeway bridge over the Western Freeway. | Revegetate, rehabilitate and enhance disturbed areas including urban forest treatments to tunnel cover, the waterway running alongside Anzac Park and any recreation areas and connections for pedestrians and cyclists. | Landscape maintenance during operation |
| Mt Coot-tha Botanic Gardens | 390,000 | 0 | No effect inside existing boundary | | |
| Victoria Park | 595,000 | 2000 (0.34%) (=1000 along ICB +1000 for Vent station) | Alongside ICB for eastbound exit lanes from tunnel is mainly within the existing road reserve–does not encroach on foot/bike path or land bridge. The footprint of the ventilation station and the ventilation outlet. | Provision of significant tree plantings to ventilation station design. | Landscape maintenance during operation |
| Toowong Cemetery | 435,000 | 0 | No effect | | |

## 5.8 Traffic on residential streets ('rat-running')

The Coordinator-General has requested an identification and assessment of any new risks of significantly increased traffic on residential streets around congestion points ('rat-running') associated with both the construction and operation phases of the project and proposed mitigation measures.

The effect of the Project on traffic volumes on local roads has been assessed in Chapter 4 of the Supplementary Report and compared to both the scenario without Northern Link, and to the EIS Reference Project.

Forecast effects on local roads are shown in **Table 4-13**. **Table 4-14** reports the modelled changes in traffic volume across screenlines located in the inner west suburbs.

The Project would provide sound levels of traffic relief across the surface network, however, the level of overall reduction in traffic on the surface network would not be as great as it would be for the EIS Reference Project. For example, by 2026, the Project is forecast to result in a reduction of 26,000 vpd across the surface network at Toowong and Milton, whereas the EIS Reference Project yielded a further 14,000 vpd reduction with the diversion of trips via the local connections. The relative comparison of effects on local roads between the EIS Reference Project and Project is tabulated in **Table 4-15** and **Table 4-16.**

Examples of the forecast effect of the Project in 2026 compared to the scenario without the Project include:

- On the Milton Road-Coronation Drive radial road corridors used by bus routes, and other roads used by east-west traffic, an 11% to 9% reduction by 2026 (26,000 vpd) in the network across the Toowong and Milton screenlines respectively is forecast. This includes traffic relief of about 14% on Coronation Drive and 6% on Milton Road.
- The Toowong activity centre would benefit from traffic reductions including a forecast decrease by 23% at High Street to 28,300 vehicles per day in 2026, which would be lower than existing traffic levels.
- Traffic on Moggill Road through Toowong would reduce by 18% to 40,800 vehicles per day, although there is a small increase at Indooroopilly (4%) as traffic from suburbs such as Indooroopilly and Taringa could access the Project via Moggill Road and the Western Freeway. This is also reflected in **Table 4-14** with an increase in traffic in 2026 over the Indooroopilly screenline slightly higher than that forecast for the EIS Reference Project.
- As the Project provides an orbital (or ring) route alternative within the network, a range of heavily trafficked regional ring roads in the broader Western Brisbane area are forecast to experience traffic reductions and improved operation. Examples at 2026 include Frederick Street (-9%) and Jubilee Terrace (-5%), which are components of MetRoad 5, and Miskin Street (-3%) and Sherwood Road (-19%) to the west of Jephson Street.
- Daily traffic reductions on many City Distributors such as Sylvan Road south of Croydon Street (-10%), Caxton Street (-11%) and Latrobe Terrace (-12%) would be experienced compared with the scenario without the project. Unlike the EIS Reference Project, traffic reduction would also be experienced on Jephson Street (-4%) and Burns Road (-4%).
- Croydon Street traffic volumes with the Project are forecast at 31,000 vpd, 4% higher than without the project (29,700 vpd) by 2026. By comparison, with the EIS Reference Project, a more substantial increase on Croydon Street was forecast, with volumes of 44,900 vpd forecast by 2026 with the local connection at Toowong. The forecast small increase in traffic on Croydon Street with the Project would occur due to a combination of factors - re-distribution of some local traffic from Moggill Road-Coronation Drive to

Milton Road (via Croydon Street) due to reduced congestion on the surface network and the assumed implementation of an inbound bus/transit lane initiative on Coronation Drive with Northern Link.

- Reductions in daily traffic are forecast with the Project on many local streets throughout the inner west suburbs such as Eagle Terrace (-11%), Haig Road (-5%), Stuartholme Road (-10%), Rainworth Road (-38%), Sylvan Road east of Milton Road (-11%), Morley Street (-11%) and Birdwood Terrace (-12%). These forecast traffic reductions are sound, although in some cases are not as strong as that offered by the EIS Reference Project, as some additional trips were diverted from local streets with the local connections in place.

## 5.9 Implementation of CPTED principles

The Coordinator-General has requested details of how the principles of the *Crime Prevention through Environmental Design Guidelines* (CPTED) will be included in the implementation of mitigation measures for the project, particularly in the areas where the portals and local connections are located.

As addressed in Chapter 14 (Urban Design and Visual Environment), CPTED Principles are to be included in all of the urban design mitigations. This will also apply to the urban mitigation project works identified for the Project in Chapter 2 of the Supplementary Report. The application of these principles will be reiterated through both the design and construction EMP performance criteria and the project specification, as identified below:

- Include CPTED principles in all of the urban and landscape design for the Project works in accordance with 'Crime Prevention through Environmental Design Guidelines for Queensland Part A: Essential features for safer places. 2007'.
- Mitigate any potential safety concerns in respect of land underneath elevated structures (including bridge structures) through innovative use of CPTED principles.
- Incorporate CPTED principles along pedestrian and cycle networks and in the design of elevated and bridge structures, including maximising illumination, visibility and sightlines for pedestrians and cyclists, avoiding the creation of loitering and hiding places, promoting natural surveillance from adjoining areas and clearly defining public spaces.
- Provide safe, legible and comfortable connections to and from all areas affected by the Project for pedestrians, cyclists and public transport users (e.g. shade and CPTED principles).
- Provide lighting along connections and at decision points in accordance with CPTED principles.

## 5.10 Additional mitigation measures for local connections

The Coordinator-General has requested an identification of additional measures that could further reduce and mitigate the impact of the local connections.

The local connections at Toowong and Kelvin Grove Road have been removed from the Project and no further mitigation is required.

# 6. Proponents Recommendations

The public notification of the EIS led to a number of submissions being made to the Coordinator-General in relation to a range of issues, and in particular the local connections at Toowong and Kelvin Grove Road. The Proponent has made a decision to remove the local connections from the Project and this has resolved many of the design issues and environmental effects of the EIS Reference Project raised in the submissions. The matters raised in the submissions were considered in the refinement of the project design for Northern Link and in the recommended environmental management objectives, performance criteria and measures contained in the Draft Outline EMP in Appendix D of the Supplementary Report.

These recommendations to the Coordinator-General for his evaluation of the Northern Link Project are made by the Proponent in consideration of the EIS, the submissions made on the EIS, and the further assessment of the Project, without the local connections, as identified in this Supplementary Report.

## 6.1 Supplementary Report Recommendations

Following a review of the submissions from both agencies and the community, this Supplementary Report provides a number of recommendations for the consideration of the Coordinator-General about the Northern Link Project. These recommendations are that:

1) The Northern Link Project should proceed, subject to a range of conditions which seek to avoid, or mitigate and manage the potential impacts of the Project during both its design, construction and operation and maintenance phases;
2) The Coordinator-General's conditions should:
   - State conditions for later IDAS approvals required for the Project;
   - Make recommendations for other approvals required for the Project; and
   - Impose conditions for the undertaking of the Project, where there is no other mechanism for conditions to be imposed ("imposed conditions"). In setting imposed conditions, the Coordinator-General may state when the imposed conditions take effect, and nominate an entity that is to have jurisdiction for the condition ("the nominated entity").
3) The Coordinator-General's conditions should address the issues and the measures set out in Section 6.2, 6.3 and 6.4 below.

## 6.2 Recommended Measures for Project Implementation

The measures for Project implementation should address the following issues:

- The need to coordinate with major projects to minimise the cumulative effects of construction and operation in the inner western suburbs;
- The need to manage the transport effects of Project implementation at the Western Freeway/Moggill Road interchange;
- The establishment of an open and effective consultation and community engagement process, including a system for receiving and addressing complaints about construction and operational issues;
- The achievement of high-quality urban design outcomes for Project infrastructure, particularly in the vicinity of the ventilation outlets adjacent to the Mt Coot-tha Botanic Gardens and within the environs of Victoria Park;

- The establishment of a comprehensive system of environmental management for both the construction and operational phases of the Project, to achieve the environmental objectives for the Northern Link Project set out in Appendix D of the Supplementary Report;
- The development of a comprehensive approach to training for the Project workforce, in addition to required technical training with regards workplace health and safety, environmental responsibilities, cultural heritage, community sensitivities and cultural awareness, and customer service;
- The establishment of construction management measures addressing spoil and construction materials handling and haulage, construction traffic management including construction vehicle management, air quality, noise and vibration management, vegetation management, surface and groundwater quality management, management of contaminated land, soil erosion and sedimentation control, pedestrian and cyclist safety and access arrangements, access arrangements for properties near the construction areas, and other matters identified in the Draft Outline EMP set out in Appendix D of the Supplementary Report;
- The establishment of operational management measures addressing traffic management including the transport of dangerous goods, air quality for both in-tunnel and ambient air, road traffic noise and plant and equipment noise, and hazards and risk; and
- The establishment and implementation of an environmental reporting protocol to address compliance with the Coordinator-General's conditions and requirements.

### 6.2.1 Coordination with other Major Projects

A coordinated approach should be taken to delivery of major transport projects in the vicinity of the Project. It is recommended that the Proponent establish an advisory committee comprising representatives from Council and the Department of Transport and Main Roads to provide information about the concurrent major transport projects to allow the cumulative construction effects from all projects to be managed. Such opportunities should aim to establish measures for:

1) Managing and monitoring construction traffic to avoid congestion, especially during periods of peak traffic flows;
2) Managing and monitoring construction car parking in localities surrounding construction work areas;
3) Managing the impacts of overlapping work programs for surface works in close proximity to major transport networks.

### 6.2.2 Measures for Approvals, Permissions, Consents etc

#### Contaminated Land

Appropriate mitigation of Project related impacts involving contaminated land must be provided where a development approval is required for material change of use of premises if all or part of the premises is on the Environmental Management Register or Contaminated Land Register. In such circumstances, it is recommended that measures include:

1) An appropriately qualified person must undertake investigations in locations where earthworks may potentially encounter contaminated soils (i.e. land that is listed on the Environmental Management Register (EMR) or identified areas from a site history and observations analysis). The Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland 1998 must be adhered to in these investigations. Any land identified as having contaminated soil must be notified to the DERM.
2) Contaminated soil can only be removed from land listed on the EMR or Contaminated Land Register (CLR) in accordance with a disposal permit under with the EP Act.

3) A Site Management Plan should be submitted to DERM for approval for contaminated land on the tunnel alignment where that land is not being removed from the EMR or CLR prior to any disturbance of the soil on that land, in accordance with:
    a. Australian and New Zealand Environment and Conservation Council/National Health and Medical Research Council - Guidelines for Assessment and Management of Contaminated Sites; and
    b. the EP Act.
4) If spills occur during the transportation of contaminated soil, the area affected will be remediated and the relevant authorities advised.

## ERA 51 – Road Tunnel Ventilation Stack Operation

The following operating conditions are recommended in relation to ERA 51 - Operating a Road Tunnel Ventilation Stack:

1) Prior to the commencement of operation of the environmentally relevant activity ("ERA"), prepare and implement an Operational Air Quality Environmental Management Plan to mitigate and manage the potential impacts on air quality arising from the operation of the tunnel ventilation system.
2) The ventilation system must be designed so that it does not prevent the possible future installation of filtration equipment to remove small particles and possibly oxides of nitrogen from vitiated air before it is released to the ambient environment during tunnel operation.
3) The western ventilation outlet, for the Project, is to be situated adjacent to the Western Freeway in the location indicated in the EIS14, and must be at least 20 metres in height above natural ground level in that location, or no less than RL 67m, whichever is the higher.
4) The eastern ventilation outlet, for the Project, is to be situated adjacent to the Inner City Bypass in the location indicated in the EIS1. The height of the ventilation outlet must be at least 15 metres above ground level in that location, or no less than RL 58m, whichever is the higher.
5) The ventilation system must be designed so that the system is capable of meeting PIARC criteria for in-tunnel air quality described in **Table 6-1** and capable of meeting the appropriate EPP (Air) and NEPM standards with allowable exceedences for ambient air quality set out in **Table 6-4**.
6) For in-tunnel air quality, the standards set out in **Table 6-1** must be achieved.

- **Table 6-1: In-Tunnel Air Quality Criteria**

| | |
|---|---|
| Carbon monoxide (CO) | 70 ppm generally<br>90ppm in peak traffic congestion |
| Nitrogen dioxide ($NO_2$) | 1 ppm (average) |
| Visibility coefficient (K) | 0.005 $m^{-1}$ |

**Note:** Monitoring and measuring protocols for each goal are set out in the PIARC guidelines.
**Note:** Peak traffic congestion occurs when traffic flows are less than 10 km/h.
**Note:** Visibility coefficient K=0.005$m^{-1}$ means clear tunnel air (visibility several hundred metres). The K-value may fluctuate with peak conditions.

7) To manage in-tunnel air quality effectively, adopt on-going, continuous monitoring linked to a system of traffic management to maintain appropriate traffic flows and consequent emission levels within nominated air quality standards in **Table 6-1**

[14] Locations of ventilation outlets indicated in the EIS, Chapter 4, section 4.2.6, Figure 4-12 and Figure 4-13.

8) Monitoring results for in-tunnel air quality must be reported. Monitoring must be undertaken in accordance with accredited procedures, and the results must be publicly available.

9) In circumstances where an exceedence of the in-tunnel air quality criteria occurs, the reporting must also describe the corrective actions taken to avoid a recurrence and to minimise the impact on ambient air quality.

10) To minimise and manage the risk of exceedance of the goals for ambient air quality, vitiated air released from each of the ventilation outlets must be monitored. Monitoring must be conducted of the air flow within each of the ventilation outlets for the Project.

11) The monitoring parameters for in-stack airflows must be consistent with the limits set out in **Table 6-2**

- **Table 6-2: Monitoring Parameters for In-stack Airflows**

| Pollutant | Goal | Unit | Measuring Period |
|---|---|---|---|
| Carbon monoxide (CO) | 70 | ppm | 1 hour |
| Nitrogen dioxide ($NO_2$) | 2.0 | $mg/m^3$ | 1 hour |
| Particulate matter less than 10 μg ($PM_{10}$) | 1.0 | $mg/m^3$ | 1 hour |

12) On-going monitoring of ambient air quality must be conducted at two monitoring stations for each ventilation outlet. The monitoring stations must be located generally within the vicinity of the sites described in **Table 6-3**.

- **Table 6-3: Monitoring Sites – Ambient Air Quality**

| Ventilation Outlet | Monitoring Locations | Location Description |
|---|---|---|
| Western | Anzac Park | In the vicinity of Wool Street and Cross Street |
| | Mt Coot-tha Gardens | In the vicinity of the main car park situated to the south of the main entrance off Mt Coot-tha Road |
| Eastern | Kalinga Avenue, Spring Hill | In the vicinity of the secondary schools |
| | Musk Avenue, Kelvin Grove | In the vicinity of Chauvel Place and Gona Parade |

13) The parameters for ambient air quality must be monitored consistent with the air quality parameters set out in **Table 6-4**.

- **Table 6-4: Ambient Air Quality Parameters**

| Pollutant | Goal | Unit | Measuring Period |
|---|---|---|---|
| Carbon monoxide (CO) | 10 | $mg/m^3$ | 8 hour maximum* |
| Nitrogen dioxide ($NO_2$) | 62<br>or 246 | $\mu g/m^3$<br>$\mu g/m^3$ | annual mean<br>1 hour maximum |
| Particulate matter less than 10 μg ($PM_{10}$) | 50 | $\mu g/m^3$ | 24 hour maximum ** |
| Particulate matter less than 2.5 μm ($PM_{2.5}$) | 25<br>8 | $\mu g/m^3$<br>$\mu g/m^3$ | 24 hour maximum<br>annual mean |

**Note:** * One day per year maximum allowable exceedence;
** Five days per year allowable exceedence, not including exceedence in ambient goals due to external events (eg dust storms, fires, major construction works)

14) Results from monitoring in accordance with accredited procedures, must be reported by the Proponent to the Chief Executive of the Department of Environment and Resource Management in accordance with **Table 6-5** and must be publicly available.

- **Table 6-5: Air quality monitoring reporting**

| | |
|---|---|
| Air Quality Reporting | Real-time Reporting:<br>for in-tunnel air quality, to be updated on an hourly basis (unvalidated) and available on-line via a project website.<br>Daily Reporting:<br>for ambient air quality, reporting of hourly unvalidated data to be reported and available daily on-line via a project website. |

15) In circumstances where monitoring identifies an exceedence of the ambient air quality goals, the reporting must also set out the performance of the tunnel ventilation system at the time and provide conclusions with regards the level of contribution by the tunnel ventilation system, if any, to the exceedence of the ambient air quality goals.

16) The location and reporting of monitoring of ambient air quality relating to tunnel operations should be reviewed by the Proponent after 5 years of operations. Should a decision be made to vary ambient air quality monitoring or reporting, a report assessing the issue and providing substantiated reasons for the decision is to be provided to the Chief Executive, DERM for comment prior to the implementation of the decision.

## Other ERAs

Other potential Environmentally Relevant Activities (ERAs), for the Project include:

- ERA 8 – Chemical storage
- ERA 63 – Sewage treatment
- ERA 64 – Water treatment
- ERA 16 – Extractive and screening activities
- ERA 43 – Concrete batching

The scale and nature of the proposed ERA works, where necessary, are to be addressed in development approval applications for such works as finally proposed following detailed design.

## State Heritage Places

Appropriate mitigation of Project related impacts to the following places listed on the Queensland Heritage Register:

- Mt Coot-tha Forest;
- Toowong Cemetery;
- Baroona, 90 Howard St Paddington;
- St Brigid's Church, Musgrave Rd Red Hill
- Ithaca Embankments Nos. 3 & 4, Musgrave Rd Red Hill;
- Gona Barracks; and
- Victoria Park, Herston.

The following measures should attach to any relevant approval for development on a heritage registered place.

1) Building condition surveys must be conducted of each place on the Queensland Heritage Register ("place of State significance") which is predicted to be impacted by the construction works prior to relevant works commencing, to record present conditions. The building condition surveys must include detailed structural

inspections prior to construction, including all timber framing, stonework, brickwork, and sealing of all timber in the stone/brickwork.

2) Prior to any works commencing which may impact on the cultural heritage values of a place of State significance, prepare specific Cultural Heritage Management Plans for each place, including the following elements:
   - incorporate the building condition surveys required in (1);
   - establish and implement monitoring programs for places of State significance to assess building movement and condition;
   - include vibration goals and their monitoring and recommended actions if the goals may be exceeded;
   - archival recording of all elements of cultural heritage significance that will be removed or demolished;
   - monitor the construction works which may uncover archaeologically significant records; and
   - consult with the DERM in an effective and timely manner, particularly where the potential exists for the construction works to impact on a place of State significance.
3) The Cultural Heritage Management Plans must be approved in writing by the chief executive, DERM, prior to any excavation, tunnelling or other work on, under or over the place of State significance.

### Aboriginal Cultural Heritage

Because an EIS has been prepared for the Northern Link Project, the Proponent must develop and have approved under the *Aboriginal Cultural Heritage Act 2003*, a Cultural Heritage Management Plan (CHMP) prior to any excavation, construction or other activity that may cause harm to Aboriginal cultural heritage.

### Connection to a State controlled road

Approval must be obtained from the chief executive of the Department of Transport and Main Roads under the *Transport Infrastructure Act 1994* for carrying out works for connections to the Western Freeway. The Proponent should consult with the Department to ascertain requirements for the connections to the Western Freeway

## 6.3 Key Recommended Measures for Construction

### 6.3.1 Community Engagement – Construction Phase

To keep the community informed during the construction phase of the Project, it is recommended that a community engagement process be developed and implemented. The process should include a range of measures, such as:

1) Prior to the commencement of construction works in a locality, formation of a Community Consultative Committee (CCC) for each locality in which a construction area is to be situated (i.e. Toowong - Western Freeway and Kelvin Grove/Herston - ICB), to provide timely advice to the Proponent about construction issues;
2) Early establishment of community information services which must include but is not limited to toll-free telephone service with 24 hour, 7 day servicing, project website and email service, regular newsletters, scheduled information sessions or open days;
3) Availability of information through the Project website and generally and in response to specific inquiries about environmental performance;
4) Early and on-going engagement with owners and occupants of premises adjacent to the proposed works or proposed mitigation measures;

5) Early notification of owners or administrators of premises such as the Mt Coot-tha Botanic Gardens, likely to be affected by proposed construction works in terms of their scale, duration, location and potential effects;

6) A complaints process, which delivers a prompt response to community concerns with relevant information, action where required, and reporting of incidents, integrated within a wider environmental reporting framework established in the environmental management plans (EMPs); and

7) Procedures to respond to complaints, issues or incidents, such as face-to-face meetings and on-going communications with affected parties and a documented process for issues resolution.

### 6.3.2 Environmental Management – Design and Construction Phase

It is recommended that comprehensive environmental management plans for design and construction ("D&C EMP") be prepared prior to the commencement of relevant stages of construction works. The D&C EMP be developed generally in accordance with the Draft D&C EMP in Appendix D of the Supplementary Report, unless varied by approval conditions. Mitigation measures may be those contained in the draft D&C EMP set out in Appendix D of the Supplementary Report, or may include other measures to achieve the environmental objectives and performance criteria, as well as any relevant statutory requirements.

To address community concerns and to demonstrate compliance with the Coordinator-General's conditions and other statutory requirements, it is recommended that the D&C EMP establish a mechanism for reporting on compliance, generally consistent with the following:

| Report | Frequency and Scope | Method of reporting |
|---|---|---|
| Construction Compliance Report | Monthly:<br>■ undertaken by an independent and appropriately qualified person;<br>■ compliance with Coordinator General's conditions and details of any non-compliances;<br>■ satisfaction of environmental objectives and performance criteria and other EMP requirements;<br>■ response to incidents of non-compliance, including corrective actions, revised construction practices, responsibility and timing;<br>■ reporting of complaints, including number of complaints, description of issue, responses and corrective actions; and<br>■ all other matters pertaining to environmental performance during construction. | 3 hardcopies and 1 electronic copy to the Coordinator-General and the Department administering the Environmental Protection Act 1994<br>1 hard copy to be provided to Brisbane City Council<br>1 hard copy to be tabled at the next meeting of the CCC<br>Posted on the project website for the duration of construction works |
| Construction Incidents and Exceedance Report | Interim Report:<br>■ within 2 days of incident or an exceedance or non-compliance with a condition, goal or requirement being identified; and<br>■ details of incident and initial response.<br>A full report must be included within the monthly report following 14 days after the Interim Report and must include;<br>■ details of the incident;<br>■ response to the incident;<br>■ corrective actions taken; | 3 hardcopies and 1 electronic copy to the Coordinator-General and the Department administering the Environmental Protection Act 1994<br>1 hard copy to be provided to Brisbane City Council<br>Posted on the project website for the duration of construction works |

| Report | Frequency and Scope | Method of reporting |
|---|---|---|
| | ■ responsibility for corrective actions;<br>■ timing of the corrective actions;<br>■ measures that have been implemented through the D&C EMP to avoid reoccurrence. | |

The framework for the D&C EMP is described in Appendix D of the Supplementary Report. It is recommended that EMPs be provided to the Coordinator-General with components to other agencies where relevant.

The D&C EMP could allow for progressive assessment of predicted impacts and design of mitigation measures prior to the relevant stages of construction works and if so, with updates of the EMP being provided to the Coordinator-General. The matters to be addressed in the D&C EMP include, but are not limited to:

1) Traffic and transport;
2) Geology and soils;
3) Hydrogeology and groundwater quality;
4) Hydrology, including surface water quality, and stormwater management;
5) Air quality;
6) Noise and vibration;
7) Flora and fauna;
8) Cultural heritage except where covered by a cultural heritage management plan under the Aboriginal Cultural Heritage Act 2003;
9) Social environment;
10) Hazard and risk, including flooding;
11) Waste management; and
12) Urban design and visual.

## General Construction

1) To avoid, or mitigate and manage construction impacts, the following recommendations are made with regards construction works generally:
2) Construct the Project to achieve the environmental objectives and performance criteria set out in the Draft EMP in Appendix D of the Supplementary Report;
3) Construction activities for works on or above the surface (except for spoil haulage which is addressed below) which generate excessive levels of noise, vibration, dust or construction traffic movements, should be restricted to between 6.30am to 6.30pm Mondays to Saturdays and at no time on Sundays or public holidays, except for special circumstances where the above-the-surface works should be conducted outside these days and hours. Examples of such special circumstances include:
   - Works on arterial roads to avoid disruption to peak traffic flows (i.e. Inner City Bypass, Western Freeway);
   - Works in rail corridors; and
   - Works involving transport of large pre-fabricated components (i.e. bridge works).
4) Construction work areas along the tunnel alignment to be designed and constructed for the management and mitigation of construction impacts by incorporating acoustic screening, ventilation and dust filtration equipment.

5) Rehabilitation of construction areas as quickly as reasonable and practicable to manage and mitigate potential impacts such as dust, soil erosion and sedimentation.
6) Construction workforce vehicles are to be directed to Project specific car parks.

### Traffic Management

It is recommended that the construction traffic EMP sub-plan be provided to the Department of Transport and Main Roads and Brisbane City Council prior to finalisation.

The D&C EMP should provide for:

1) nominated haulage routes for all construction haulage which occur on motorways and arterial roads and suburban routes, and on other roads only where necessary for the most direct access to worksites and spoil placement sites;
2) management of the haulage vehicle fleet to minimise traffic disruption, avoid dust and noise beyond work areas and minimise haulage impacts.

### Spoil Haulage, Handling and Placement

It is recommended that the D&C EMP provide for the management of spoil haulage, handling and placement, in particular:

1) Placement of spoil at spoil placement areas to comply with the performance criteria of the Filling and Excavation Code in City Plan.
2) Spoil-handling facilities and areas, and tunnel shafts servicing tunnel machines to be enclosed with ventilated, acoustically-lined sheds in which spoil handling (being stockpiling, loading into haulage trucks) is conducted at all times; and
3) Spoil handling facilities (including any conveyor) must be design, constructed and operated to be safe and secure, not impede existing public access without prior agreement of Council and present the minimum visual and landscape impact as far as practicable;
4) When decommissioned, the rehabilitation of spoil handling areas including any conveyor system to pre-existing ground conditions and landscaping, generally consistent with a landscape master plan to be prepared and provided to the Coordinator-General; and
5) Spoil handling at the quarry to be consistent with the existing development approval conditions for that facility.

### Air Quality

The Draft EMP provides for a range of management measures to control potential air quality impacts during construction, and sets out the air quality goals to be achieved during construction. It is recommended that the goals be adopted, and that mitigation measures be required to, as far as practicable, ensure the Project achieves the adopted goals. It is recommended that at least 2 fixed air quality monitoring stations be established for each of the Western Freeway worksite and the ICB construction area for the duration of construction works.

### Noise and Vibration

The Draft EMP in Appendix D of the Supplementary Report provides for a range of management measures to control potential noise and vibration impact during construction. In addition, the Draft EMP establishes noise and vibration goals for the construction phase of the Project. It is recommended that the goals be adopted and mitigation measures be required to, as far as practicable, ensure the Project achieves the adopted goals.

### Building Works

Toll road control buildings associated with the Project must be designed sympathetically to the surrounding environment. Temporary buildings associated with the Project must be designed and sited to reduce impacts on adjoining properties where practicable.

Toll road operation and maintenance depots associated with the Project must be sited on premises with an appropriate Area designation under City Plan.

Buildings over worksites and toll road control buildings must be designed and constructed so that shadowing and light spill onto adjacent premises is minimised and consistent with the relevant Australian Standards.

### Ped/Cycle Connectivity

A pedestrian/cycle path consistent with the existing ped/cycle infrastructure must be constructed from the Western Freeway ped/cycle overpass adjacent to the Mt Coot-tha Roundabout to the main entrance of the Mt Coot-tha Botanic Gardens prior to commencement of operations.

### Groundwater and Surface Water

The Project must be constructed in accordance with the Hydrology and Groundwater Quality D&C EMP and the Surface Water Quality EMP outlined in Appendix D of the Supplementary Report to the EIS.

### Urban Design

The Project must be constructed in accordance with the Urban Design and Visual Landscape D&C EMP outlined in Appendix D of the Supplementary Report to the EIS.

## 6.4 Key Recommended Measures for Operations

### 6.4.1 Community Engagement - Operation

To respond to community concerns during the operational phase of the Project, it is recommended that there be a mechanism for receiving and dealing with complaints about the operational aspects of the Project, including achievement of the environmental objectives for the Project. The complaints mechanism should:

1) Be similar to that established for the construction phase;
2) Provide an avenue to resolve operational impacts where the environmental performance criteria have not been met;
3) Provide for prompt responses to complaints made, with information, corrective action where required, and reporting back to the complainant and Proponent; and
4) Be incorporated within the wider environmental reporting framework for the Project.

### 6.4.2 Complaints – Operational Phase

To address community concerns about Project operations, it is recommended that there be a formal process for receiving and dealing with complaints in relation to the environmental objectives. This process should be the same as that established during the construction phase.

### 6.4.3 Environmental Management – Operational Phase

It is recommended that comprehensive environmental management plans for Operation and Maintenance ("O&M EMP") be prepared prior to the commencement of tunnel operations. The O&M EMP should be developed generally in accordance with the Draft O&M EMP in Appendix D of the Supplementary Report, unless varied by approval conditions. Mitigation measures may be those contained in the draft O&M EMP set out in Appendix D of the Supplementary Report, or may include other measures to achieve the environmental objectives and performance criteria, as well as any relevant statutory requirements.

The matters to be addressed in the O&M EMP include, but are not limited to:

1) Traffic and transport;
2) Hydrogeology and groundwater quality;
3) Surface water quality, including stormwater management;
4) Air quality;
5) Noise; and
6) Hazard and risk, including flooding.

To address community concerns and to demonstrate compliance with the Coordinator-General's conditions and other statutory requirements, it is recommended that the O&M EMP establish a mechanism for reporting on compliance, generally consistent with the following:

| Report | Frequency and Scope | Method of reporting |
|---|---|---|
| Operations Phase Compliance Report | Six-monthly:<br>■ Undertaken by a suitably qualified person;<br>■ compliance with Coordinator General's Conditions;<br>■ satisfaction of environmental objectives and EMP requirements;<br>■ response to incidents of non-conformance, including where necessary corrective actions, revised operations practices, responsibility and timing; and<br>■ all other matters pertaining to environmental performance during operations. | 3 hardcopies and 1 electronic copy to the Coordinator-General and the Department administering the Environmental Protection Act 1994<br>1 hard copy to be provided to Brisbane City Council<br>Posted on the project website |
| Operations Incidents and Exceedance Report | Interim Report;<br>■ within 2 days of incident or an exceedance of a condition, goal or requirement, being identified; and<br>■ details of incident and initial response.<br>Full Report<br>■ within 14 days of incident or an exceedance of a condition, goal or requirement, being identified; and<br>■ details of incident, response, corrective action, responsibility and timing. | 3 hardcopies and 1 electronic copy to the Coordinator-General and the Department administering the Environmental Protection Act 1994<br>1 hard copy to be provided to Brisbane City Council<br>Posted on the project website for the duration of construction works |

## Monitoring – Operational Phase

It is recommended on-going monitoring for operational impacts be undertaken for aspects of the Project that are of concern or interest to the community, including, noise from ventilation plant and other plant and equipment, road traffic noise (limited period), and surface water quality.

## Traffic Management

Prior to the commencement of operations, it is recommended that the following measures be established in an operational traffic EMP sub-plan:

1) To manage in-tunnel air quality where an incident in the tunnel system or adjacent road network requires traffic to cease flowing or slow below design speeds for the ventilation system;
2) To manage traffic flows into and out of the tunnel system, having regard for conditions in each tunnel and on the surface road network;
3) To enable emergency services and other relevant entities to attend to incidents in the tunnel system, evacuations if necessary, maintenance requirements and other tunnel operating requirements; and
4) To assist with efficient transport network operations, through consultation with key stakeholders.

## Noise

It is recommended that, prior to the commencement of operations, measures be established to mitigate and manage, if necessary, the potential for noise from Project operations, including:

1) Ventilation system operating noise at each portal, ventilation station and ventilation outlet; and
2) Road traffic noise in specified locations identified in predictive modelling.

Where the road traffic planning noise levels are already exceeded at sensitive locations it may not be reasonable and practicable to achieve compliance with the planning noise levels set out in the O&M EMP in Appendix D of the Supplementary Report. In these instances, either the "status-quo" noise levels should be maintained (i.e. maintain noise levels at levels anticipated in 2026 the design year, without the Project), or specific measures to address localised impacts should be established in consultation with potentially-affected property owners and occupants.

## Hazard and Risk

Prior to the commencement of operations of the Project, it is recommended that the Proponent prepare an incident response plan and consult with the Queensland Police Service, Queensland Fire Service and Queensland Ambulance Service on the content of that plan. In addition to incidents relating to Project operations, the incident response plan should address potential external factors which may affect Project operations (i.e. flooding, traffic incidents on the surface road network, incidents threatening Project security).

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SKM Connell Wagner

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